8. HAZARD ASSESSMENT

The overall objectives of this hazard assessment section are to provide guidance on the following:

- Evaluating all groundwater-monitoring tasks to determine the extent that radiological, chemical, and physical hazards might potentially impact site personnel by all routes of entry
- Establishing the necessary personnel and area monitoring required to evaluate exposure, determine adequate action levels to mitigate potential exposures, and provide specific actions to be followed if action levels are reached
- Determining engineering controls, isolation methods, work practices to limit personnel exposure, administrative controls, and appropriate respiratory protection and protective clothing to protect site personnel from hazards.

8.1 Environmental Restoration Long-Term Sitewide Groundwater-Monitoring Activities

Personnel will be exposed to potential safety and physical hazards and limited chemical and radiological hazards while conducting groundwater-monitoring tasks. The magnitude of these hazards is related to the specific nature of the tasks being conducted and relative location of the worker to the potential hazard. In general, well installation, maintenance, decommissioning, and abandonment activities will present greater hazards to personnel than routine groundwater sampling tasks. Engineering controls will be implemented (whenever possible), along with work practice controls, use of technical procedures and work orders, real-time monitoring, administrative controls, and site-specific hazard training to further identify and mitigate potential exposures and hazards. Specific hazards for groundwater-monitoring activities that are considered operational activities will be identified and mitigated in accordance with MCP-3562, "Hazard Identification, Analysis, and Control of Operational Activities." Hazards during groundwater-monitoring activities, which are maintenance or construction related, will be identified and mitigated in accordance with STD-101, "Integrated Work Control Process." The work control documents (JSAs, TPRs, work orders) arising from MCP-3562 or STD-101 review will augment this HASP and further detail specialized protective equipment and mitigation measures for each groundwater-monitoring task.

Several tables are presented to identify the potential chemical and radiological concentrations based on past monitoring. Physical hazards that might be encountered—as well as monitoring methods, action limits, and other hazard-specific mitigation measures—are also addressed. These tables include:

- Table 8-1 presents an evaluation of chemicals that may be used or encountered during groundwater-monitoring tasks with respect to potential routes of exposure, symptoms of overexposure, and the qualitative exposure risk potential based on the chemical nature of these materials and project tasks.

  Note: Not all chemicals listed in Table 8-1 are applicable to all wells in all locations nor is this table all-inclusive.

- Table 8-2 summarizes primary groundwater-monitoring tasks, associated hazards, and mitigation.
- Table 8-3 lists the hazards that may be monitored by Industrial Hygiene personnel during groundwater-monitoring activities.
- Table 8-4 lists industrial hygiene equipment available for monitoring chemical hazards.
- Table 8-5 presents action levels and associated responses for specific hazards.

Table 8-1. Evaluation of chemicals and radiological exposures.

Hazardous Material (CAS #)	Exposure Limit[a] (PEL/TLV)	Routes of Exposure[b]	Symptoms of Over Exposure[c] (Acute and Chronic)	Target Organs and Systems	Carcinogen (Source)	Exposure Potential (Regardless of Personal Protective Equipment)
Project Chemicals or Compounds Brought to Site						
Bentonite (sodium bentonite)[d] 7631-86-9	10 mg/m^3 (inert nuisance dust)	Ih, Con	Mucous membrane and respiratory tract irritation	Lungs	No	**Moderate potential** Used for well installation and completion
Silica, crystalline—quartz (cement)[d] (14808-60-7)	TLV—0.05 mg/m^3 (respirable fraction) OSHA PEL (Respirable) TWA 10 mg/m^3/ (%SiO_2 + 2) Quartz (total dust): TWA 30 mg/m^3/ (%SiO_2 + 2)	Inh, con	Pulmonary fibrosis, silicosis	Respiratory	ACGIH A2	**Moderate Potential** Used for well installation and completion.
Nitric acid[d] (7697-37-2) Vapor density—2 to 3 11.95 eV	ACGIH TLV—2 ppm STEL—4 ppm OSHA PEL-TWA—2 ppm	Ih, Ig, Con	Irritation of the eyes, skin, mucous membrane; delayed pulmonary edema; pneumonitis; bronchitis; dental erosion	Eyes, skin, respiratory system, teeth	No	**Low Potential** Used for water sample preservation. Pipettes will be used to deliver acid to sample container.
Sulfuric acid[d] (7664-93-9)	ACGIH TLV— 1 mg/m^3 STEL— 3 mg/m^3 OSHA PEL-TWA 1 mg/m^3	Ih, Ig, Con	Irritation of the eyes, skin, nose, throat; pulmonary edema; bronchitis; emphysema; conjunctivitis; stomatis; dental erosion; eye, skin burns; dermatitis	Eyes, skin, respiratory system, teeth	ACGIH A2 (as mist)	**Low Potential** Used for water sample preservation. Pipettes will be used to deliver acid to sample container.

Table 8-1. (continued).

Hazardous Material (CAS #)	Exposure Limit[a] (PEL/TLV)	Routes of Exposure[b]	Symptoms of Over Exposure[c] (Acute and Chronic)	Target Organs and Systems	Carcinogen (Source)	Exposure Potential (Regardless of Personal Protective Equipment)
CO (carbon monoxide) (630-08-0) Portable gasoline or diesel equipment	TLV—25 ppm OSHA TWA—50 ppm	Ih	Headache; tachypnea; nausea; lassitude (weakness, exhaustion); dizziness; confusion; hallucinations; cyanosis; depressed S-T segment of electrocardiogram; angina; syncope	Cardiovascular system, lungs, blood, CNS	No	**Low Potential** Equipment will be operated outdoors.
Diesel exhaust	TLV—0.05 mg/m^3 (particulate aerodynamic diameter <1 µm (ACGIH 2000 notice of intended changes)	Ih	Respiratory irritation of the nose, throat, or lungs with stinging and redness of the eyes, headache, nausea, dizziness, unconsciousness	Respiratory system	ACGIH A2	**Low Potential** Equipment will be operated outdoors.
Diesel fuel[d] (8008-20-6) VD—>1	TLV—100 mg/m^3 (ACGIH 2000 notice of intended changes)	Ih, S, Con	Eye irritation, respiratory system changes, dermatitis	Eye, respiratory system	No	**Low–Moderate Potential** Will be used to refuel equipment.
NO_x (nitrogen oxides) (incomplete combustion by-product)—portable equipment operating	TLV—3 ppm (NO_2) STEL—5 ppm OSHA C—5 ppm (NO_2)	Ih	Irritation of the eyes, nose, throat; cough; mucoid frothy sputum; decreased pulmonary function; chronic bronchitis; dyspnea (breathing difficulty); chest pain; pulmonary edema; cyanosis; tachypnea; tachycardia	Eye, respiratory system, cardiovascular system	No	**Low Potential** Equipment will be operated outdoors.

Table 8-1. (continued).

Hazardous Material (CAS #)	Exposure Limit[a] (PEL/TLV)	Routes of Exposure[b]	Symptoms of Over Exposure[c] (Acute and Chronic)	Target Organs and Systems	Carcinogen (Source)	Exposure Potential (Regardless of Personal Protective Equipment)
Groundwater/Soil Cutting Contaminants						
Zinc (1314-13-2)	PEL—5 mg/m^3 (oxide fume) TLV—5 mg/m^3 (oxide fume)	Ih	Metal fume fever, chills, muscle ache, nausea, dry throat, cough, weakness, headache, blurred vision, lower back pain, vomiting, difficulty breathing.	Respiratory system	No	**Low Potential** Trace source term in groundwater samples and soil cuttings
Manganese (7439-96-5)	OSHA ceiling—5 mg/m^3 TLV—0.2 mg/m^3	Ih, Ig	Parkinson's, insomnia, confusion, metal fume fever, dry throat, cough, difficulty breathing, low-back pain, vomiting, and kidney damage.	Respiratory system, central nervous system, blood, kidneys	No	**Low Potential** Trace source term in groundwater samples and soil cuttings
Lead (7439-92-1)	PEL—0.05 mg/m^3 TLV—0.05 mg/m^3	Ih, Ig, Con	Weakness, insomnia, facial pallor, weight loss, abdominal pain, anemia, wrist and ankle paralysis, kidney disease, and eye irritation.	Eyes, GI tract, central nervous system, kidneys, blood, gingival tissue	Yes—IARC Yes—NTP	**Low Potential** Trace source term in groundwater samples and soil cuttings
Chromium[e] (7440-47-3)	OSHA ceiling—0.1 mg/m^3 TLV—0.01 mg/m^3	Ih, Ig, Con	Respiratory, liver and kidney damage; nasal septum perforation; eye injury; skin ulcer; blood problems, dermatitis.	Blood, respiratory system, liver, kidneys, eyes, skin	A1-ACGIH	**Low Potential** Trace source term in groundwater samples and soil cuttings
Beryllium (7440-41-7)	OSHA TWA—0.002 mg/m^3 OSHA Ceiling—0.005 mg/m^3 TLV—0.002 mg/m^3 SENSITIZER STEL-0.01mg/m^3	Ih, S, Con	Anorexia, weight loss, exhaustion, chest pain, cough, eye irritation, dermatitis, pulmonary insufficiency.	Eyes, skin, respiratory system	A1-ACGIH	**Low Potential** Trace source term in groundwater samples and soil cuttings
Arsenic (7440-38-2)	PEL—0.01 mg/m^3 TLV—0.01 mg/m^3	Ih, Ig, S, Con	Respiratory, nasal ulceration, gastrointestinal disturbances, dermatitis.	Liver, kidneys, skin, lungs, lymphatic system	A1-ACGIH	**Low Potential** Trace source term in groundwater samples and soil cuttings

Table 8-1. (continued).

Hazardous Material (CAS #)	Exposure Limit[a] (PEL/TLV)	Routes of Exposure[b]	Symptoms of Over Exposure[c] (Acute and Chronic)	Target Organs and Systems	Carcinogen (Source)	Exposure Potential (Regardless of Personal Protective Equipment)
Cadmium (7440-43-9) Vapor density—NA	TLV—0.01 mg/m^3 inhalable fraction TLV—0.002 mg/m^3 respirable fraction PEL—0.005 mg/m^3 (29 CFR 1910.1027)	Ih, Ig	Respiratory, nervous system, irritation of mucous membranes, dryness of mouth, headache.	Kidneys and respiratory tract, blood, prostate	A2—ACGIH Yes—NTP Yes—IARC Yes—OSHA	**Low Potential** Trace source term in groundwater samples and soil cuttings
Mercury (7439-93-2) VD—1.01	TLV—0.025 mg/m^3	S, Ih	Coughing, chest pain, respiratory distress, salivation, diarrhea, depression, irritability	Skin, eyes, respiratory central nervous system, kidneys	No	**Low Potential** Trace source term may be encountered in groundwater and soil cuttings
Thallium (7440-28-0)	TLV—0.1 mg/m^3	Ih, S, Ig, Con	Nausea, diarrhea, abdominal pain, vomit; ptosis, strabismus; peripheral neuropathy, tremor; retrosternal tight, chest pain, pulmonary edema; seizure, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Eyes, respiratory system, central nervous system, liver, kidneys, gastrointestinal tract, gocy hair	No	**Low Potential** Trace source term may be encountered in groundwater and soil cuttings
Cobalt (7440-48-4)	TLV—0.02 mg/m^3	Ih, Ig, Con	Cough, dyspnea, wheezing, decreased pulmonary functional low weight; dermatitis; diffuse nodular fibrosis; respiratory hypersensitivity, asthma	Skin, respiratory system	No	**Low Potential** Trace source term may be encountered in groundwater and soil cuttings
Methane (74-82-8)	Simple asphyxiant	Ih	"Inert" gas that acts primarily as a simple asphyxiant without other significant physiologic effect when present in high concentrations in air	Displaces oxygen so oxygen does not make it to the lungs	No	**Low Potential** Soil gas associated with the monitoring wells at the CFA landfills

Table 8-1. (continued).

Hazardous Material (CAS #)	Exposure Limit[a] (PEL/TLV)	Routes of Exposure[b]	Symptoms of Over Exposure[c] (Acute and Chronic)	Target Organs and Systems	Carcinogen (Source)	Exposure Potential (Regardless of Personal Protective Equipment)
1,2-Dichloroethene (cis and trans) (156-59-2; 156-60-5)	PEL—200 ppm TLV—200 ppm	Ih, Ig, Con	Respiratory, eye irritation, central nervous system depression.	Eyes, respiratory system, central nervous system	No	**Low Potential** Trace source term in groundwater samples and soil cuttings
1,1,1-Trichloroethane (71-55-6) Vapor density—4.6 Ionization energy—11.1 eV	TLV—350 ppm STEL—450 ppm Ceiling—2,460 ppm	Ih, Ig, S, Con	Nervous system, dermis, respiratory, eyes, central nervous system depression, and headache.	Central nervous system, skin, eyes, cardiovascular system	No	**Low Potential** Trace source term in groundwater samples and soil cuttings
Vinylidene Chloride (1,1-Dichloroethylene) (75-35-4)	TLV—5 ppm	Ih, Con	Irritation eyes, skin, throat; dizziness, headache, nausea, dyspnea; liver, kidney, dysfunction; pneumonitis	Eyes, skin, respiratory system, central nervous system, liver, kidneys	No	**Low Potential** Trace source term in groundwater samples and soil cuttings
1,1-Dichloroethane (75-34-3)	TLV—100 ppm	Ih, Ig, Con	Irritation of the skin; CNS depression; liver, kidney, lung damage	Skin, liver, kidneys, lungs, central nervous system	No	**Low Potential** Trace source term in groundwater samples and soil cuttings
Trichlorofluoromethane (75-69-4)	PEL—1,000 ppm ACGIH Ceiling—1,000 ppm	Ih, Ing, Con	Lack of coordination, tremor; dermatitis; cardiac arrhythmias, cardiac arrest; asphyxia	Skin, respiratory system, cardiovascular system	No	**Low Potential** Trace source term in groundwater samples and soil cuttings

Table 8-1. (continued).

Hazardous Material (CAS #)	Exposure Limit[a] (PEL/TLV)	Routes of Exposure[b]	Symptoms of Over Exposure[c] (Acute and Chronic)	Target Organs and Systems	Carcinogen (Source)	Exposure Potential (Regardless of Personal Protective Equipment)
Radionuclides—Gross Alpha, Gross Beta, Tritium (*INEEL Radiological Control Manual* requirements)						
Radionuclides (whole body exposure)	INEEL—1.5 rem/ year project ALARA dose limit, in accordance with *INEEL Radiological Control Manual* or ALARA task Posting of radiation areas in accordance with *INEEL Radiological Control Manual*, Table 2-3	Whole body		Blood forming cells, GI tract, and rapidly dividing cells	Yes	**Low–Negligible Potential** Trace source term in groundwater samples
Radionuclides (fixed and removable surface contamination)	Posting of contamination areas in accordance with *INEEL Radiological Control Manual*, Table 2-4, Sections 835.404.c and 835.603.f	Ig, Con		GI tract, ionization of internal tissue	Yes	**Low potential** Trace source term in groundwater samples

Table 8-1. (continued).

Hazardous Material (CAS #)	Exposure Limit[a] (PEL/TLV)	Routes of Exposure[b]	Symptoms of Over Exposure[c] (Acute and Chronic)	Target Organs and Systems	Carcinogen (Source)	Exposure Potential (Regardless of Personal Protective Equipment)

a. ACGIH 2002 *Threshold Limit Values Booklet* and OSHA 29 CFR 1910 substance-specific standards

b. Ig = ingestion, Ih = inhalation, S = skin absorption, Con = eye or skin contact

c. Nervous system: dizziness, nausea, and lightheadedness. Dermis: rashes, itching, and redness. Respiratory: respiratory effects. Eyes: tearing and irritation.

d. MSDSs for these chemicals are available at the project site.

e. Exposure limits vary by valence state; the most conservative limits are listed.
ACGIH = American Conference of Governmental Industrial Hygienists
ALARA = as low as reasonably achievable
CFA = Central Facilities Area
CFR = *Code of Federal Regulations*
CNS = central nervous system
GI = gastrointestinal
IARC = International Agency for Research on Cancer
INEEL = Idaho National Engineering and Environmental Laboratory
MSDS = material safety data sheet
NTP = National Toxicology Program
OSHA = Occupational Safety and Health Administration
PEL = permissible exposure limit
RWP = radiological work permit
STEL = short-term exposure limit
TLV = threshold-limit value
TWA = time-weighted average
VD = vapor density

Table 8-2. Groundwater-monitoring tasks, associated hazards, and mitigation.

Tasks	Potential Hazards and Hazardous Agents	Hazard Elimination, Isolation, or Mitigation
• Site preparation • Groundwater sampling • Groundwater field measurements • Sample preservation • Well surface maintenance/construction • Internal well component maintenance/change out • Well component decommissioning • Well abandonment • Drilling and well installation	1. Contact or exposure to chemicals at the task site—Direct contact with water sample preservation acids, contact with cement (high pH), bentonite, silica, fuels, lubricants, dust, CO and NO_x, and trace metals/chemicals in groundwater and soil. 2. Pinch points, caught-between, struck-by, and overhead hazards—Well component assembly and placement, vehicle or equipment movement, well construction/abandonment, excavation, crane or boom truck use, drill rig operation, material movement/stacking/handling. 3. Lifting and back strain—Moving equipment and materials, sampling coolers, pumps, well components, and generators. 4. Tripping hazards, uneven terrain, walking, and working surfaces—Uneven surfaces, wet/muddy/snow or ice covered surfaces, cables, cords, and lines on the ground. 5. Hoisting and rigging—Pulling/positioning pumps and equipment at project site. 6. Heated surfaces, heat, and cold stress—Generator motor and exhaust surfaces, outdoor work, summer and fall temperatures, and PPE usage. 7. Hazardous noise levels—Trucks, heavy equipment, compressors, and hand tools. 8. Energy sources—Elevated materials/components; 110VAC electrical, mechanical, thermal, and compressed air systems. 9. Snakes/animals/ticks/spiders/Hantavirus—material storage areas, inside well casing/under well access lids, under well surface completion cement pads, or other areas where small animals might hide	1. DWA or CWA; MSDS for all chemicals used; PPE to avoid skin contact; acid use in lab hood; CO and NO_x monitoring; industrial hygiene monitoring, trained fuel handlers; HASP training, and PPE (as required). 2. Qualified operators, spotter, backup alarms; DWA, CWA; established truck, traffic lanes (as required); body position awareness; hand, head, body protection; tag lines for hoisting and rigging; work controls. 3. Mechanical lifting and movement devices; proper lifting techniques; do not lift more than 50 lb or 1/3 of body weight; store materials in racks and at waist or chest height (where possible). 4. CWA, DWA; identify and mitigate tripping hazards and mark where possible; keep walking and working surfaces clean (where feasible); foot protection entry. 5. CWA; qualified operators; certified rigging; follow PRD-160 requirements; tag lines; and wind restrictions. 6. CWA, DWA and restricted areas; identify known heated surfaces where contact is possible; industrial hygiene monitoring and work-rest or warm-up cycles (as required) for heat and cold stress; proper selection of work clothing or PPE; personnel training. 7. CWA, DWA; industrial hygiene sound-level monitoring and dosimetry for source identification; and hearing protection devices. 8. CWA and restricted areas; posted and labeled sources; hoisting and rigging standard. Practices (as stated above) training; isolation of energy source (lockout/tagout) for all maintenance/decommissioning/abandonment activities; outage or subsurface investigation (as required); PPE. 9. Use caution when lifting well access lid; watch ground surface for pests; do not disturb rodent nesting areas; leather boots, full-length clothing, gloves.

CWA = controlled work area
DWA = designated work area
HASP = Health and Safety Plan
MSDS = material safety data sheet
PPE = personal protective equipment
PRD = program requirements document

Table 8-3. Groundwater monitoring project hazards to be monitored.

Tasks	Hazards to be Monitored[a]
• Site preparation • Groundwater and lysimeter sampling • Groundwater field measurements • Sample preservation • Well surface maintenance/construction • Internal well component maintenance/change out • Well component decommissioning • Well abandonment • Drilling and well construction/installation	CO and NO_x—operations with generators or equipment in areas with poor air movement Nuisance dust (inhalable/respirable)—well surface construction, decommissioning, and abandonment tasks (use of bentonite and excavation tasks) Crystalline silica dust (respirable)—drilling and well construction/installation, well surface construction and abandonment (use of cement) Hazardous noise levels[b]—trucks, heavy equipment, drill rig, compressors, generator, and other equipment, as deemed appropriate Organic compounds—contaminants (as listed on Table 8-1) and fueling operations, and general operations with potential for exposure to organic hydrocarbons, as deemed appropriate Diesel exhaust—in areas with poor ventilation only, as deemed appropriate.

a. Monitoring and sampling will be conducted (as deemed appropriate by project Industrial Hygiene personnel) based on specific tasks, site conditions, and professional judgment.

b. Sound-level meter will be used for instantaneous sound levels and to determine hearing protection requirements. Additional noise dosimetry may be conducted, as deemed appropriate, based on the nature of the sound-level sources and duration of exposure or project.

Table 8-4. Equipment available for monitoring groundwater-monitoring project hazards.

Chemical or Radiological Hazard to be Monitored or Sampled	Equipment and Monitoring and Sampling Method [a]	
Petroleum hydrocarbons, VOCs Nuisance particulates, NOC (inhalable/respirable) Crystalline silica (respirable) Diesel exhaust	Personal sampling pumps with appropriate media. Passive samplers for organic vapors. Industrial hygienist will determine appropriate NIOSH, OSHA, or other established sampling method.	
Petroleum hydrocarbons, VOCs	FID, PID, or equivalent	
CO, NO_2	Direct-reading instrument with CO and/or NO_2 cells	
Radionuclides	TLD, electronic dosimetry in accordance with the RWP. Alarming personnel contamination monitoring and hand-held instruments or portable air monitors.	
Hazardous noise levels (>85 dBA for an 8-hour workday, 84 dBA for a 10-hour day, >140-dBA impact)	ANSI Type S2A sound-level meter and ANSI S1.25-1991 dosimeter (A-weighted scale for TWA dosimetry, C-weighted scale for impact-dominant sound environments)	
Heat and cold stress	Heat stress—WBGT, body weight, fluid intake	Cold stress—ambient air temperature, wind chill charts

a. Air sampling will be conducted as deemed appropriate by project Industrial Hygiene personnel based on initial direct-reading instrument data, groundwater monitoring operation, and professional judgment.

ANSI = American National Standards Institute
CO = carbon monoxide
dBA = decibel A-weighted
FID = flame ionization detector
NIOSH = National Institute of Occupational Safety and Health
NOC = not otherwise classified
NO_2 = nitrogen dioxide
OSHA = Occupational Safety and Health Administration
PID = photoionization detector
RWP = radiological work permit
TLD = thermoluminescent dosimeter
TWA = time-weighted average
VOC = volatile organic compound
WBGT = wet bulb globe temperature

Table 8-5. Action levels and associated responses for groundwater monitoring project hazards.

Contaminant or Agent Monitored	Action Level	Response Taken if Action Level is Exceeded
Nuisance particulates (NOC)	>10 mg/m^3 (inhalable fraction) >3 mg/m^3 (respirable fraction)	1. Move personnel to upwind position of source. 2. Use wetting or misting methods to minimize dust and particulate matter. 3. If wetting or misting methods prove ineffective, THEN abandon area being worked OR don respiratory protection[a] (as directed by industrial hygienist).
VOCs, including petroleum hydrocarbons	None detected	No actions are required.
	Detectable, but <half the PEL or TLV (whichever is lower) as listed in Table 8-1. (*Note: If more than one VOC is expected, use the most conservative action level.*)	Move personnel to upwind side of source. Continue working, continuously monitoring.
	>Half the PEL/TLV, but <the PEL/TLV	**Evacuate area:** If episodic: Leave area until vapor dissipates. Monitor continuously or don minimum Level C respiratory protection[a] and continue working. If sustained: Don minimum Level C respiratory protection[a] and continue working with periodic monitoring (minimum every 5 minutes).
	>or = PEL/TLV	**Evacuate area**: If episodic: Don minimum Level C respiratory protection[a] and continue working with periodic monitoring (minimum every 5 minutes). If sustained: Consult health and safety officer and field team leader to determine course of action.
Crystalline silica (respirable)	>0.05 mg/m^3	Move personnel to upwind position of source. Use wetting or misting methods to minimize dust and particulate matter. IF wetting or misting methods prove ineffective, THEN abandon area being worked OR don respiratory protection[a] (as directed by industrial hygienist).
CO (in poorly ventilated areas)	15 to 25 ppm in workers' breathing zone	Reposition source, monitor near suspected source for elevated levels, ensure personnel are on upwind side of source, and continue to monitor.

Table 8-5. (continued).

Contaminant or Agent Monitored	Action Level	Response Taken if Action Level is Exceeded
	>25 ppm sustained for 2 minutes in workers' breathing zone	IF >25 ppm: Identify source and leave area until level dissipates below 25 ppm, then continuous monitoring. IF levels cannot be kept below 25 ppm, THEN cease operations and contact maintenance personnel to inspect equipment source.[b]
NO_2 (in poorly ventilated areas)	1 to 3 ppm in workers' breathing zone	Reposition source, monitor near suspected source for elevated levels, ensure personnel are on upwind side of source, and continue to monitor.
	>3 but <5 ppm sustained for 2 minutes in workers' breathing zone	If >3 but <5 ppm: Identify source and leave area until level dissipates below 3 ppm, then continuous monitoring. IF levels cannot be kept below 3 ppm, THEN reposition source downwind and workers upwind, and contact maintenance personnel to inspect equipment source.[b]
	>5 ppm sustained for 1 minute in workers' breathing zone	Move personnel unwind of source, shut down equipment when safe to do so, and contact maintenance personnel to inspect equipment source.[b,c]
Diesel exhaust (as elemental carbon)	**Note**: Elevated CO and NO_2 concentrations should be used as an indication for elevated diesel exhaust concentrations.	IF elevated CO and NO_2 concentrations are indicated, THEN, reposition source, monitor near suspected source for elevated levels, ensure personnel are on upwind side of source, and continue to monitor.
	>0.02 mg/m^3 TWA	IF >0.02 TWA, THEN cease operations and contact maintenance personnel to inspect equipment source.[b]
Hazardous noise levels	<85 dBA 8-hour TWA, < 84 dBA 10-hour TWA	No action.
	85 to 114 dBA	Hearing protection required to attenuate to below 85 dBA for an 8-hour TWA or 84 dBA for a 10-hour TWA (based device NRR).
	(a) >115 dBA (b) > 40 dBA	(a) Isolate source and evaluate NRR for single device. Double protection, as needed. (b) Control entry, isolate source. Only approved double protection worn.

a. Respiratory protection will be prescribed by the project industrial hygienist (see Section 9).

b. All equipment must be secured and left in a safe configuration before leaving area.

c. At no time will personnel continue to work in areas with sustained concentrations of NO_2 above 5 ppm (Occupational Safety and Health Administration ceiling value).

DBA = decibel A-weighted NOC = not otherwise classified NRR = noise reduction rating PEL = permissible exposure limit
TLV = threshold limit value TWA = time-weighted average VOC = volatile organic compound

8.2 Routes of Exposure

Exposure pathways for potential contaminants that might be encountered during groundwater-monitoring activities are directly related to the source of exposure and associated route(s) of entry. Engineering controls, industrial hygiene monitoring, training, and work controls are all intended to mitigate potential exposures and uptake of contaminants. However, the potential for exposure to contaminants still exists.

Exposure pathways include the following:

- Inhalation of vapors from trace contaminants in water samples or drill cuttings, preservation acid vapors, or nuisance or silica-containing dusts during well construction, decommissioning, or abandonment tasks. Inhalation of these sources could lead to signs or symptoms described in Table 8-1 for the specific hazard.

- Skin absorption and contact with preservation acids, cement, bentonite dust, or fuel contact (during refueling tasks). Fuel can be absorbed through unprotected skin; acids and cement/bentonite have a corrosive effect on skin, eyes, and mucous membranes, thereby resulting in skin irritation or potential absorption through broken skin.

- Ingestion of trace contaminants adsorbed to dust particles or on surfaces, resulting in potential uptake of contaminants through the gastrointestinal (GI) tract that could result in GI irritation (radionuclides) or deposition to target organs.

- Injection by breaking of the skin while handling equipment or materials or migration through an existing wound resulting in localized irritation, contamination, uptake of soluble contaminants, and deposition of insoluble contaminants.

Monitoring will be conducted to identify sources for potential exposure by all routes or entry and to develop mitigative measures to include engineering controls, hold points, and PPE usage (where warranted).

8.3 Environmental and Personnel Monitoring

The potential for exposure to chemical, radiological, physical, and environmental hazards exists from various sources that might be encountered during groundwater-monitoring tasks. Engineering and administrative controls, worker training, and the use of protective equipment will mitigate most of these hazards. Monitoring with direct-reading instruments will be conducted, where deemed appropriate, to provide Industrial Hygiene personnel with real-time data to assess the effectiveness of these controls. In addition, designated and controlled work areas will be established to limit access to areas near potential hazards to authorized project personnel only (see Section 7).

8.3.1 Industrial Hygiene Monitoring

Various direct-reading instruments and full-period sampling equipment may be used to determine the presence of chemical and physical agents and to access environmental conditions. The frequency and type of sampling and monitoring will be determined by changing site conditions, direct-reading instrument results, observation, and professional judgment.

All full- and partial-period airborne contaminant sampling may be conducted, as deemed appropriate by the project IH, based on direct-reading instrument readings and changing site conditions. If

conducted, all air sampling will be done using applicable NIOSH or OSHA methods and in conformance to the INEEL safety and health manuals. Risk assessments for site personnel will be conducted in accordance with the requirements of MCP-153, "Industrial Hygiene Exposure Assessment."

8.3.2 Industrial Hygiene Instrument and Equipment Calibration

All monitoring instruments will be maintained and calibrated in accordance with the manufacturer's recommendations, existing industrial hygiene protocol, and in conformance to the INEEL safety and health manuals. Direct-reading instruments will be calibrated, at a minimum, before daily use and more frequently as determined by the project IH.

8.3.3 Exposure Action Limits

Action levels have been established to prevent and mitigate potential personnel exposure to chemical and physical hazards during groundwater-monitoring activities. The project HSO, in conjunction with the IH and safety professional, will evaluate activities each day to identify changes in site-specific conditions. If action levels are reached, personnel will take the appropriate actions, as listed in Table 8-5.

The action levels in Table 8-5 are in place to ensure that the established 8-hour time-weighted average (TWA) occupational exposure limits for these chemical compounds are not exceeded. When the associated responses to action levels are followed, an additional safety factor is invoked to further reduce the likelihood that the TWAs will be exceeded. The ceiling value for $N0_2$ is different from a TWA in that this value should not be exceeded even for short time periods. Therefore, a sustained concentration of NO_2 above 3 ppm measured in the breathing zone of project personnel warrants the immediate actions listed in Table 8-5.

8.4 Physical and Environmental Hazard Evaluation, Control, and Monitoring

The physical and environmental hazards present at this project site and the methods that will be used to monitor and control them are described in this section. It is critical that all personnel are aware and understand the scope of work for each task, associated hazards, the equipment to be used, and the controls that are in place to eliminate or mitigate the hazards.

8.4.1 Physical Hazards

The physical hazards encountered while performing tasks at groundwater-monitoring sites pose the most significant risk to personnel. Section 6 provides general safe-work practices that must be followed at all times. The following sections describe specific industrial safety hazards and procedures to be followed to eliminate or minimize potential hazards to project personnel.

8.4.1.1 Back Strain. Movement of loaded sample coolers, well components, field measurement equipment, generators, compressors, and other support equipment could result in a back injury or strain. Manual material handling will be minimized through task design and use of mechanical or hydraulic lifts, whenever possible, and positioning of materials at the best working levels at the well locations. Project personnel must not lift more than 50 lb or 1/3 their body weight, whichever is less. Two-person lifts could be required to move some equipment. The IH will evaluate all tasks involving manual lifting in accordance with MCP-2692, "Ergonomics Program."

8.4.1.2 Powered Equipment and Tools. All power equipment and tools will be properly maintained and used by qualified individuals according to the manufacturer's specifications. For all work performed with powered equipment, PRD-5101, "Portable Equipment and Handheld Power Tools," will be followed. All power tools and equipment used outdoors will be protected by ground-fault circuit interrupters.

8.4.1.3 Heavy Equipment and Moving Machinery. The hazards associated with the operation of heavy equipment include injury to personnel, equipment damage, or property damage. All heavy equipment will be operated in the manner in which it was intended and according to the manufacturer's instructions. Only authorized personnel will be allowed near operating heavy equipment and should maintain visual communication with the operator. All equipment operators will be qualified to operate the equipment being used. Work site personnel will comply with MCP-2745, "Heavy Industrial Vehicles," and PRD-5123, "Motor Vehicle Safety." Additional safe practices include:

- Only qualified operators will operate heavy equipment.
- All heavy equipment will have backup alarms.
- When warranted, a spotter shall be used.
- Personnel shall maintain a safe distance from operating equipment and shall stay alert of equipment movement. Personnel shall avoid placing themselves between fixed objects and operating equipment and equipment pinch points, and personnel shall remain outside of the equipment swing and turning radius.
- Walking directly behind or to the side of heavy equipment without the operator's knowledge is prohibited. All precautions will have been taken before moving heavy equipment.
- While operating heavy equipment in the work area, the equipment operator will maintain communication with a designated person responsible for providing direct voice contact or approved standard hand signals. In addition, all site personnel in the immediate work area will be made aware of the equipment operations.
- Where warranted and established, equipment will use established traffic lanes and access ways and will be stored so as not to endanger personnel at any time.
- Heavy equipment operators will observe safe clearance distances with overhead power lines during movement and operation.

8.4.1.4 Hoisting and Rigging. A crane or boom truck and associated rigging will be required to position equipment and pull pumps and likely will be required during decommissioning or abandonment tasks. All hoisting and rigging operations will be accomplished in accordance with the DOE-STD-1090-01, "Hoisting and Rigging," and PRD-160, "Hoisting and Rigging." Some basic requirements include, but are not limited to, the following:

- Under no circumstances will personnel be permitted under any suspended load
- Tag lines shall be used to control the load (unless they create an additional hazard)
- Contact or positioning of a suspended load by hoisting and rigging personnel will be limited to conditions defined in PRD-160

- The swing radius of the load will be cleared and only authorized personnel involved with the lift will be allowed in the CWA during hoisting and rigging tasks

- Crane operators will observe safe clearance distances with overhead power lines during movement and operation.

Depending on the complexity of the lift and determination as to whether it is deemed a critical lift, a lifting sketch or similar rigging plan might be required to be developed for hoisting particular objects or equipment. Where required, the sketch (or rigging plan) will contain a sketch of the object to be lifted, including the lifting points or rigging method, center of gravity, gross weight, and required rigging.

All rigging used will have a current load certification tag (or equivalent) demonstrating operability. All equipment operators will be qualified to operate the specific equipment used. In addition, for mobile cranes or boom trucks, the operator or designated person will visually inspect items following each day or before use if the crane has not been in regular service. These items include, but are not limited to, the following:

- All control mechanisms for maladjustment interfering with proper operation

- Crane hooks and latches for deformation, cracks, and wear

- Hydraulic systems for proper oil level

- Lines, tanks, valves, pumps, and other parts of air or hydraulic systems for leakage

- Hoist ropes for kinking, crushing, bird caging, and corrosion

- All anti-two-block, two-block warning, and two-block damage prevention systems for proper operation.

Note:	The operator or other designated person will examine deficiencies and determine whether they constitute a safety hazard. If deficiencies are found, they will be reported to the safety professional; hoisting and rigging operations will not proceed until deficiencies are corrected.

8.4.1.5 Drilling Hazards. Various types of drilling equipment may be used at the new well installation locations to core to the required depths. Drilling personnel will be aware of potential drilling equipment hazards and body positioning during all material-handling tasks. Several specific hazards associated with drill rigs are described below.

8.4.1.5.1 Slips—Slips are toothed wedges positioned between the drill pipe and the master bushing or rotary cable to suspend the drill string in the well bore when it is not supported by the hoist. Most accidents associated with slip operations are related to manual material handling; strained backs and shoulders are common.

8.4.1.5.2 Tongs—Tongs are large, counter-weighted wrenches used to break apart torqued couplings on the drill pipe. Both sets of tongs have safety lines; when breakout force is applied to the tongs, the tongs or the safety lines could break and injure a worker standing near them. Accidents can occur when the driller activates the wrong tong lever and an unsecured tong swings across the rig floor at an uncontrolled velocity. A common accident attributable to tongs can occur when a worker has a hand or finger in the wrong place in attempting to swing and latch the tong onto the drill pipe, resulting in crushing injuries to or amputation of the fingers.

8.4.1.5.3 Elevators—Elevators are a set of clamps affixed to the bails on the swivel below the traveling block. They are clamped to each side of a drill pipe and hold the pipe as it is pulled from the well bore. Accidents and injuries can occur during the latching and unlatching tasks; fingers and hands can get caught and crushed in the elevator latch mechanism. If the pipe is overhead when the latching mechanism fails, the pipe could fall on workers working on the drill floor.

8.4.1.5.4 Catlines—Catlines are used on drilling rigs to hoist material. Accidents that occur during catline operations could injure the worker doing the rigging as well as injure the operator. Minimal control over hoisting materials can cause sudden and erratic load movements, which could result in hand and foot injuries.

8.4.1.5.5 Working Surfaces—The rig floor is the working surface for most tasks performed in well drilling operations. The surface is frequently wet from circulating fluid, muddy cuttings, and water used or removed from the borehole during drilling operations. Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, slips, and falls.

8.4.1.5.6 Material Handling—The most common type of accident that occurs during material handling is when a load is being handled and a finger or toe gets caught between two objects. Rolling stock can shift or fall from a pipe rack or truck bed. Fingers and hands can get caught between sampling barrels, breakout vices, and tools.

8.4.1.5.7 High-Pressure Lines—A high-pressure diversion system will be used to carry cuttings away from the borehole. All high-pressure lines will be equipped with positive locking connectors (e.g., cams) and will be secured with whip checks should a connection fail. The project safety professional will be consulted regarding the number and placement of whip checks or equivalent restraining devices.

8.4.1.6 Electrical Hazards and Energized Systems. Electrical equipment and tools, as well as overhead lines, could pose shock or electrocution hazards to personnel. Safety-related work practices, including inspections, will be employed to prevent electric shock or other injuries resulting from direct or indirect electrical contact. If work on energized systems is necessary, these practices will conform to the facility supplemental requirements in PRD-5099, "Electrical Safety"; MCP-3650, "Chapter IX Level I Lockouts and Tagouts"; or MCP-3651, "Chapter IX Level II Lockouts and Tagouts"; and Parts I through III of National Fire Protection Association (NFPA) 70E, "Standard for Electrical Safety Requirements for Employee Work Places."

All electrical work will be reviewed and completed under the appropriate work controls (e.g., work orders, TPRs, or equivalent subcontractor work controls) and will only be performed by qualified personnel. In addition, any generators used at the project sites will be properly wired and grounded in accordance with PRD-5099, "Electrical Safety," and 29 CFR 1926, Subpart K, "Electrical." Electrical power tools, equipment, and cords must be inspected for damage before use. If damaged, they should be tagged and removed from service.

8.4.1.7 Personal Protective Equipment. Wearing PPE will reduce a worker's ability to move freely, see clearly, and hear directions and noise that might indicate a hazard. In addition, PPE can increase the risk of heat stress. Work activities at the task site will be modified, as necessary, to ensure that personnel are able to work safely in the required PPE. Work site personnel will comply with PRD-5121, "Personal Protective Equipment." Project PPE levels for groundwater-monitoring activities are described in Section 9 and listed in Table 9-1.

8.4.1.8 Decontamination. Decontamination of drilling and sampling equipment will be required. Section 10 describes decontamination techniques in detail. Personnel will conduct decontamination tasks in accordance with applicable TPRs or MCPs and will wear the prescribed PPE. The FTL will provide direction for all equipment decontamination tasks to ensure their effectiveness.

8.4.1.9 Flammable and Combustible Hazards. Flammable or combustible liquids will be used at the task sites for refueling equipment. Diesel fuel used at the task site for fueling the equipment will be safely stored, handled, and used. Portable motorized equipment (e.g., generators and light plants) will be shut off and allowed to cool down, in accordance with the manufacturer's operating instructions, before refueling to minimize the potential for a fuel fire.

Only FM/UL-approved flammable liquid containers, labeled with the contents, will be used to store fuel. All fuel containers will be stored at least 15 m (50 ft) from any facilities (e.g., trailers) and ignition sources or will be stored inside an approved flammable storage cabinet. Additional requirements are provided in MCP-584, "Flammable and Combustible Liquid Storage and Handling." Portable fire extinguishers, with a minimum rating of 10A/60BC, will be strategically located at the site to combat Class A, B, and C fires.

The accumulation of combustible materials will be strictly controlled at groundwater-monitoring sites. Disposal of combustible materials will be assessed at the end of each shift. Class A combustibles (e.g., trash, cardboard, rags, wood, and plastic) will be properly disposed of in approved containers.

8.4.1.10 Project Equipment Fire Hazards. Combustible or ignitable materials in contact with or near exhaust manifolds, catalytic converters, or other ignition sources could result in a fire. The INEEL Fire Department might have to authorize any hot work to be done if the fire danger at the INEEL is deemed high or extreme. The project safety professional will be contacted to initiate a hot work permit. If a hot work permit is issued, a trained fire watch will be assigned. Fire extinguishers will be positioned in the DWA or CWA on or near site equipment that has exhaust heat sources and all equipment capable of generating ignition (or that has the potential to spark). At least one radio or cell phone will be required when conducting groundwater-monitoring tasks so emergency communications can be established should the INEEL Fire Department or nearest incident response team need to be summoned. Section 11 details emergency communications.

8.4.2 Environmental Hazards

Environmental hazards will be encountered during groundwater-monitoring activities based on the nature of the work (outside), locations of the wells, and time of year when these tasks will be conducted (year-round). The following sections provide guidelines for environmental hazard mitigation.

8.4.2.1 Heat Stress. Summer temperatures and the use of PPE that prevents the body from cooling could lead to environmental conditions where heat stress could occur. High ambient air temperatures can result in increased body temperature, heat fatigue, heat exhaustion, or heat stroke that can lead to symptoms ranging from physical discomfort, unconsciousness, to death. Personnel must inform the FTL or HSO when experiencing any signs or symptoms of heat stress or observing a fellow worker experiencing them. Heat stress hazards are further described in Table 8-6 and in MCP-2704, "Controlling Exposure to Heat and Cold Stress."

Table 8-6. Heat stress signs and symptoms.

Heat-Related Illness	Signs and Symptoms	Emergency Care
Heat rash	Red skin rash and reduced sweating	Keep the skin clean, change all clothing daily, and cover affected areas with powder containing cornstarch or with plain cornstarch.
Heat cramps	Severe muscle cramps, exhaustion, sometimes with dizziness or periods of faintness	Move the patient to a nearby cool place and give the patient half-strength electrolytic fluids. If cramps persist, or if signs that are more serious develop, seek medical attention.
Heat exhaustion	Rapid, shallow breathing; weak pulse; cold, clammy skin; heavy perspiration; total body weakness; dizziness that sometimes leads to unconsciousness	Move the patient to a nearby cool place. Keep the patient at rest, give the patient half-strength electrolytic fluids, treat for shock, and seek medical attention. DO NOT TRY TO ADMINISTER FLUIDS TO AN UNCONSCIOUS PATIENT.
Heat stroke	Deep, then shallow breathing; rapid, strong pulse, then rapid, weak pulse; dry, hot skin; dilated pupils; loss of consciousness (possible coma); seizures or muscular twitching	Cool the patient rapidly. Treat for shock. If cold packs or ice bags are available, wrap them and place one bag or pack under each armpit, behind each knee, one in the groin, one on each wrist and ankle, and one on each side of the neck. Seek medical attention as rapidly as possible. Monitor the patient's vital signs constantly. DO NOT ADMINISTER FLUIDS OF ANY KIND.

Note: Heat exhaustion and heat stroke are extremely serious conditions that can result in death and should be treated as such. Transport individual immediately to the nearest medical facility.

Monitoring for heat stress conditions will be performed in accordance with the requirements of MCP-2704, "Controlling Exposure to Heat and Cold Stress." The IH will inform the FTL and HSO of necessary adjustments to the work and rest cycle, depending on the ambient weather conditions, work conditions, type of PPE worn, and the physical response of work operations personnel. In addition, physiological monitoring may be conducted to determine if personnel are replenishing liquids fast enough. A supply of cool drinking water will be provided and consumed only in approved areas. The IH or HSO may interview workers periodically to ensure that the controls are effective and that excessive heat exposure is not occurring. Workers will be encouraged to monitor their body signs and take breaks if symptoms of heat stress occur.

Individuals showing any of the symptoms of heat exhaustion listed in Table 8-6 will (1) stop work, (2) exit the work area, (3) be decontaminated (as appropriate), (4) remove protective clothing (as applicable), (5) move to sheltered area to rest, (6) be provided cool drinking water, and (7) be monitored by a medic or cardiopulmonary resuscitation (CPR)/first-aid certified employee.

8.4.2.2 Low Temperatures. Exposure to low temperatures will be a factor during groundwater-monitoring activities. Winter conditions, relatively cool ambient temperatures, and wet or windy conditions increase the potential for cold injury to personnel. The project IH and HSO will be responsible for obtaining meteorological information to determine if additional cold stress administrative

controls are required. The hazards and monitoring of cold stress are discussed in MCP-2704. Additional cold weather hazards from working on snow- or ice-covered surfaces exist during fall or winter months. Slip, fall, and material-handling hazards are increased under these conditions. Every effort must be made to ensure that walking surfaces are kept clear of ice. The FTL or HSO should be notified immediately if slip or fall hazards are noted at groundwater-monitoring sites.

8.4.2.3 Inclement Weather Conditions. Groundwater-monitoring activities occur outdoors and year-round, and inclement weather is to be expected. Inclement or adverse weather conditions (sustained strong winds 25 mph or greater, electrical storms, winter storms, heavy precipitation, wildfire, icy or muddy roads, blowing dust, limited visibility due to fog or dusty conditions, etc.) could develop that pose a threat to personnel conducting groundwater-monitoring tasks. The FTL will be responsible for checking weather reports and communicating this information to field team members. The FTL, in consultation with the HSO, will evaluate changing weather conditions and determine if environmental conditions pose unacceptable hazards to personnel or equipment. If required, based on changing inclement weather conditions, the FTL will direct field personnel to secure equipment in a safe configuration and seek shelter (commensurate with the weather conditions).

Note: Wind restrictions governing hoisting and rigging activities are provided in PRD-160, "Hoisting and Rigging."

8.4.2.4 Noise. Personnel working at the task site may be exposed to noise levels that exceed 85 decibel A-weighted (dBA) for an 8-hour TWA and 84 dBA for a 10-hour TWA from various pieces of equipment in use. The effects of high sound levels (i.e., noise) include the following:

- Personnel being startled, distracted, or fatigued
- Physical damage to the ear, pain, and temporary or permanent hearing loss
- Interference with communication that would warn of danger.

The IH will perform noise measurements (using the instruments listed in Table 8-4) in accordance with MCP-2719, "Controlling and Monitoring Exposure to Noise," to determine if personnel are above allowable noise exposure levels. A threshold limit value (TLV) of 85 dBA TWA will be applied to personnel exposed to noise levels over no more than an 8-hour day. This level is based on a 16-hour recovery period in a low-noise environment. If personnel are required to work longer than 8 hours in a hazardous noise environment, then the TLV will be adjusted to a lower value. The project IH must be consulted regarding modifications to the 85 dBA for an 8-hour TLV and 84 dBA for a 10-hour TWA value.

Personnel whose noise exposure routinely meets or exceeds the allowable level will be enrolled in the INEEL OMP or appropriate subcontractor hearing conservation program. Personnel working on jobs that have noise exposures greater than 85 dBA (84 dBA for a 10-hour TWA) will be required to wear hearing protection until noise levels have been evaluated and will continue to wear the hearing protection, as specified by the IH, until directed otherwise.

8.4.2.5 Biological Hazards. Groundwater-monitoring sites are located in areas that provide habitat for various rodents, insects, and reptiles. Based on biological studies done at the INEEL, indigenous deer mice have been known to carry the Hantavirus. The Hantavirus could be present in the nesting and fecal matter of deer mice. During the course of mobilization and intrusive activities, the potential exists for project personnel to disturb nesting or fecal matter and from material-handling tasks in the weather structure. If such materials are disturbed, they can become airborne and create a potential inhalation

pathway for the virus. In addition, contact and improper removal of these materials could provide additional inhalation exposure risks.

If suspect rodent nesting or excrement material is encountered, the project IH will be notified immediately and no attempt will be made to remove or clean the area. Following an evaluation of the area, the IH will provide the necessary guidance for protective equipment, mixing, and application of the disinfecting bleach solution as well as proper method of waste disposal (see MCP-2750, "Preventing Hantavirus Infection").

Snakes, spiders, ticks, mosquitoes, and insects also could be encountered. Common areas to avoid include material stacking and staging areas, under existing structures (e.g., well surface completion cement pads), under boxes, and other areas that provide shelter for snakes and spiders. Protective clothing will prevent personnel from direct contact with insects. However, repellant could be required during Level D activities.

8.4.2.6 Walking and Working Surfaces. Slip, trip, and fall hazards exist from uneven terrain, protruding rocks, holes, well surface completion configurations, and environmental conditions leading to muddy or wet surfaces and snow- and ice-covered walking surfaces. Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, slips, and falls. Where identified or anticipated, personnel will be made aware of existing tripping hazards during the prejob briefing, and mitigation steps will be taken to eliminate or minimize slip hazards. Snow- or ice-covered walking surfaces that present a hazard during groundwater-monitoring tasks will be cleared or a combination of sand and salt will be applied. In addition, personnel will wear appropriate footwear for the conditions anticipated to be encountered.

8.4.2.7 Excavation, Surface Penetrations, and Outages. Excavation and surface penetration tasks could be required in conjunction with well construction, decommissioning, or abandonment. Underground utilities will be identified through the use of a subsurface investigation in accordance with PRD-22, "Excavation and Surface Penetration." A competent person will be designated for all excavation tasks. Definitions are provided below.

In accordance with 29 CFR 1926.32(f), "Competent Person," a competent person for excavation activities means "one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them."

The competent person will evaluate the excavation process to ensure that the proper slope and access requirements are being met, and the competent person will conduct inspections, as required by PRD-22. This inspection shall include (at a minimum) indications of possible cave-in, water accumulation, failure of any protective system component, stability of spoil piles and adjacent structures, and indications of hazardous atmosphere.

Access into any excavation will be limited to authorized personnel only and will occur only after the competent person has inspected the excavation. If the excavation is adjacent to a roadway, then barricades will be used to prevent vehicles from entering the area around the excavation.

8.4.3 Confined Spaces

During groundwater-monitoring tasks, no confined spaces have been identified or are anticipated to be encountered. If a suspected confined space is encountered and not properly posted, it will be treated as

a permit-required confined space until an assigned safety professional or IH (see MCP-2749, "Confined Spaces") makes a determination.

8.5 Other Site Hazards and Inspections

Task site personnel should continually be alert for potential hazards and immediately inform the FTL or HSO so corrective actions can be taken to eliminate or mitigate the hazard. The HSO and FTL will visually inspect the site to ensure that barriers and signs are being maintained, unsafe conditions are corrected, and debris is not accumulating on the site. These inspections will be conducted in addition to regulatory-mandated inspections (as applicable).

The FTL (or designee) will perform periodic safety inspections, using an appropriate checklist, in accordance with MCP-3449, "Safety and Health Inspections." In addition, targeted or required self-assessments may be performed in accordance with MCP-8, "Self-Assessment Process for Continuous Improvement." All inspections and assessments will be noted in the FTL logbook. Health and safety professionals present at the task site may, at any time, recommend changes in work habits to the FTL. However, all changes that could affect the project's written work control documents (i.e., HASP, JSAs, and RWPs) must have concurrence from the appropriate project technical discipline representative onsite and have a Document Action Request (DAR) (Form 412.11) prepared, as required.

9. PERSONAL PROTECTIVE EQUIPMENT

Industrial safety hazards are the primary hazards associated with groundwater-monitoring tasks. Anyone entering DWAs or CWAs must be protected against potential safety and contaminant exposure hazards. In addition, personnel who enter DWAs or CWAs must wear (as a minimum) Level D PPE. For ER work sites, this includes (as a minimum) a hard hat, safety glasses with side shields, and sturdy leather shoes above the ankle. Based on the sampling data available to date, groundwater chemical and radiological contaminants of concern present only a minimal exposure potential to project personnel. This section addresses required PPE for conducting groundwater-monitoring tasks and contingencies for upgrading PPE, if required.

The purpose of PPE is to shield or isolate personnel from chemical, radiological, and physical hazards that cannot be eliminated through engineering or other controls. It is important to realize that no PPE ensemble can protect against all hazards under all conditions; however, work practices and adequate training will provide a greater level of protection to workers.

Selection of the proper PPE to protect project site personnel is based on the following:

- Groundwater-monitoring project tasks to be conducted (e.g., well construction/installation, sampling, field measurements, maintenance, decommissioning, and abandonment)
- Expected chemicals and radionuclides that might be encountered
- Potential contaminant routes of entry
- Physical form and chemical characteristics of contaminants
- Acute and chronic effects from exposure to chemicals and radionuclides
- Local and systemic toxicity
- Anticipated exposure levels (e.g., contact and airborne)
- Hazard analysis evaluation (see Section 8).

Generally, the PPE is divided into two broad categories: (1) respiratory protective equipment and (2) personal protective clothing. Both of these categories are incorporated into the standard four levels of protection (Levels A, B, C, and D). Table 9-1 provides guidance in the selection process for respiratory and protective clothing. Each of the major groundwater-monitoring tasks has been evaluated based on the site-specific hazards, and the most appropriate PPE level (including modifications) has been determined. Task-based respiratory protection and the protective clothing required for groundwater-monitoring tasks are listed in Table 9-1.

Table 9-1. Groundwater-monitoring project task-based personal protective equipment requirements and modifications.

Task	Level of Personal Protective Equipment	Category: Primary or Contingency	Modifications and Comments
All Groundwater-Monitoring Activities			
• Site preparation • Groundwater and lysimeter sampling • Groundwater field measurements • Sample preservation • Well surface maintenance and construction • Internal well component maintenance/change out • Well component decommissioning • Well abandonment • Drilling and well construction	Level D	Primary	Level D PPE as defined in Section 9.2. Modification for specific hand protection for material handling and sampling tasks will be outlined in specific work control document (e.g., JSA).
	Modified Level D	Upgrade contingency	Upgrading to modified Level D (protective clothing, Tyvek coveralls, or equivalent) could be required if action levels are exceeded or contact with cement or bentonite material cannot be avoided (prolonged and extensive skin contact).
	Level C	Upgrade contingency	If airborne contaminants increase to concentrations above established action limits, Level C full-face air-purifying respiratory protection will be worn in conjunction with chemical protective clothing (cartridge to be selected by project IH based on airborne hazard).

IH = industrial hygienist
JSA = job safety analysis
PPE = personal protective equipment

9.1 Respiratory Protection

Respiratory protection is not anticipated to be required for groundwater-monitoring tasks, based on the tasks to be completed, quantity and form of potential hazardous constituents, and engineering controls that will be implemented. Therefore, respiratory protection will be made available only as a contingency if action limits are exceeded or site conditions change such that additional respiratory protection is required (i.e., upgraded). Assigned protection factors for respiratory devices will not be exceeded if respiratory protection is required.

If required, all personnel required to wear respirators will complete training and be fit-tested before being assigned a respirator, according to the training and documentation requirements of this HASP. Requirements for respirator use (i.e., emergency use, storage, cleaning, and maintenance), as stated in MCP-2726, "Respiratory Protection," will be followed.

9.2 Personal Protective Equipment Levels

The following sections provide detail and explanation of the PPE levels that will be used for groundwater-monitoring activities. Modifications to these levels will be made under the direction of the HSO, in consultation with the project IH and safety professional, as appropriate. Such modifications are routinely employed during HAZWOPER activities to maximize efficiency and to meet site-specific needs without compromising personnel safety and health.

Table 9-1 lists each task or assignment and the corresponding PPE level, as well as any additional or special items necessary for personal protection at the task site. The HSO, IH, and safety professional will determine what modifications to the PPE levels listed in Table 9-1 are appropriate.

9.2.1 Level D and Modified Level D Personal Protective Equipment

Level D or modified Level D PPE will serve as the primary PPE level for all groundwater-monitoring tasks. Level D PPE will only be selected as a work uniform and not on a site with respiratory or skin absorption hazards requiring whole body protection. It does not provide protection against airborne chemical hazards, but rather is used for protection against nuisance contamination and physical hazards. Level D PPE will only be allowed in areas that have been characterized as such or are known to have never been contaminated. The IH or RCT may modify the Level D PPE ensemble to provide protection from skin or other physical hazards, but will not include the addition of respiratory protection.

Level D PPE consists of the following:

- Coveralls or work clothes (as determined by the IH and safety professional)
- Hard hat
- Eye protection and safety glasses with side shields as a minimum (see PRD-5121, "Personal Protective Equipment")
- Hand protection for all material-handling tasks (e.g., leather for material handling tasks and nitrile or equivalent of sampling and acid-handling tasks, as specified by the IH)
- Safety footwear (steel or protective toe and shank, as determined by the safety professional)
- Optional Level D modifications consisting of the following:
    - Chemical protective clothing (i.e., Tyvek and Saranex), as prescribed by project IH
    - Chemically resistant hand and foot protection (i.e., inner and outer gloves and boot liners)
    - Any specialized protective equipment (i.e., hearing protection, face shields, welding goggles, and aprons)
    - Chemical goggles for cement or bentonite mixing operations. Chemical goggles will be required whenever there is a potential for a chemical splash hazard.

9.2.2 Level C Personal Protective Equipment

Level C PPE will only be worn if the airborne action levels to airborne chemical levels (or other constituents) are exceeded and cannot be controlled. In addition, task site chemical contaminants must be well characterized, indicating that (1) personnel are protected from airborne exposures by wearing air-purifying respirators with the appropriate cartridges, (2) no oxygen-deficient environments exist

(<19.5% at sea level), and (3) that there are no conditions that pose immediate danger to life or health. Basic Level C PPE will include the Level D ensemble with the following respiratory and whole body protection upgrades:

- Full face piece air-purifying respirators equipped with a NIOSH-approved cartridge (the IH will specify the type of cartridge [e.g., organic vapor, high-efficiency particulate air, or combination])
- Chemical-resistant coveralls (i.e., Tyvek QC, Tychem 7500, and Saranex-23-P), as prescribed by project IH
- Chemical-resistant outer shoe or boot cover (the IH will specify the material)
- Inner chemical-resistant nitrile rubber gloves with cotton liners (as determined by the IH)
- Outer chemical-resistant Viton or polyvinyl alcohol gloves (as determined by the IH)
- Optional Level C modifications (any specialized protective equipment [i.e., hearing protection, welding lens, and aprons]).

9.3 Protective Clothing Upgrading and Downgrading

The project HSO, in consultation with the project IH and safety professional, will be responsible for determining when to upgrade or downgrade PPE requirements. Upgrading or downgrading PPE requirements based on current conditions is a normal occurrence. If changing conditions are encountered, new work control documents (e.g., JSA) might need to be written or updated to reflect these changes. Additional reasons for upgrading or downgrading PPE requirements include:

- Upgrading criteria or conditions (work will stop immediately if an upgrade in PPE is required)
  - Unstable or unpredictable site hazards (chemical or other)
  - Contaminants that present difficulty in monitoring or detecting
  - Known or suspected presence of skin absorption hazards
  - Temporary loss or failure of any engineering controls
  - Identified source or potential source of respiratory hazard(s)
  - Change in the task procedure that could result in increased contact with contaminants or a change in the requirements for meeting any of the criteria listed above
- Downgrading criteria
  - New information of monitoring data that shows the contaminant levels to be lower than established action limits
  - Implementation of new engineering or administrative controls that eliminate or significantly mitigate hazards
  - Elimination of potential skin absorption or contact hazards
  - Change in site conditions that results in removal of physical hazards or reduces or isolates them to a controlled area

- Completion or change in tasks that results in the elimination of key hazards that require higher levels of PPE.

9.4 Inspection of Personal Protective Equipment

All PPE ensemble components must be inspected before use and when in use within groundwater monitoring DWAs or CWAs. Once PPE is donned, self-inspection and the use of the "buddy" system will serve as the principle forms of inspection. If at any time PPE should become damaged or unserviceable, the individual will inform others of the problem and proceed directly to the controlled work area exit point to doff and replace the equipment. In addition, all PPE that becomes grossly contaminated with grout or other material will be cleaned or replaced. Table 9-2 provides an inspection checklist for common PPE items.

Table 9-2. Personal protective equipment inspection checklist.

Personal Protective Equipment Item	Inspection
Gloves	Before use: • Pressurize gloves to check for pinholes. To pressurize: blow in the glove, roll until air is trapped, and inspect. No air should escape. Inspect leather gloves for tears, excessive wear, or deterioration or permeation. While wearing in the DWA or CWA: • Inspect for tears, punctures, and damage. Replace if unserviceable.
Modified Level D and C clothing	Before use: • Visually inspect for imperfect seams, nonuniform coatings, and tears. Hold PPE up to the light and inspect for pinholes, deterioration, stiffness, and cracks. Check cloth coveralls for tears and rips and deterioration. While wearing in the DWA or CWA: • Inspect for evidence of chemical attack, such as discoloration, swelling, softening, and material degradation. Inspect for tears, punctures, and zipper or seam damage. Check all taped areas to ensure that they are still intact.
Respirators (if required) (full face piece, air-purifying)	Before use: • Check condition of the face piece, head straps, valves, connecting lines, fittings, and all connections for tightness. • Check cartridge to ensure proper type or combination for atmospheric hazards to be encountered. Inspect threads and O-rings for pliability, deterioration, and distortion.

CWA = controlled work area
DWA = designated work area
PPE = personal protective equipment

10. DECONTAMINATION PROCEDURES

No decontamination beyond the normal sampling equipment procedures and typical doffing of protective clothing (if required) is anticipated during groundwater-monitoring activities. Other activities—such as well drilling, abandonment, and maintenance—could require the decontamination of process equipment. If contact with potentially contaminated surfaces cannot be avoided, then additional engineering controls, in combination with PPE upgrades, might be necessary to control the contact hazard. However, if chemical or radiological contamination is encountered at levels requiring decontamination, this section provides guidance on how it will be conducted.

10.1 Contamination Control and Prevention

Contamination control and prevention procedures will be implemented to minimize personnel contact with contaminated surfaces if such surfaces are encountered and contacted during groundwater-monitoring activities. The following contamination control and prevention measures will be employed if contamination is encountered:

- Identify potential sources of contamination, and design containment, isolation, and engineering controls to eliminate or mitigate any potential for contact or release of contaminants
- Limit the number of personnel, equipment, and materials that enter the contaminated area
- Implement immediate decontamination procedures to prevent the spread of contamination (if contamination is found on the outer surfaces of equipment)
- Use only the established controlled entry and exit points from the contaminated area to minimize the potential for cross-contamination and expedite contamination control surveys
- Wear disposable outer garments and use disposable equipment (where possible)
- Use hold point within procedures and work orders to monitor for contamination (where anticipated).

10.2 Equipment and Personnel Decontamination

Decontamination procedures for personnel and equipment are not anticipated to be required beyond normal PPE change out and TPRs for sampling equipment cleaning.

10.2.1 Equipment Decontamination

Decontamination of sampling equipment will be conducted in accordance with TPR-6541, "Decontaminating Sampling Equipment," and TPR-6575, "Decontaminating Sampling Equipment in the Field." If contact with potentially contaminated surfaces cannot be avoided, then additional engineering controls, in combination with PPE upgrades, might be necessary to control the contact hazard. Equipment will be decontaminated based on the source of contamination.

If radionuclide decontamination operations are required for equipment or areas, they will be performed in accordance with Chapter 4 of *Manual 15B–Radiation Protection Procedures.* The HSO and project IH will evaluate nonradionuclide decontamination on a case-by-case basis to determine the most appropriate PPE. (Level C protective clothing initially will be selected if airborne contaminants might be

generated until site monitoring can demonstrate downgrading is warranted.) Specific personnel and equipment decontamination methods are provided in the following subsections.

10.2.2 Personnel Decontamination

Groundwater-monitoring activities will be conducted in Level D PPE unless upgrading is warranted. Engineering controls in conjunction with work controls and proper handling of groundwater samples will serve as the primary means to eliminate the need for personnel decontamination. If modified Level D protective clothing is required, all items will be inspected following the list in Table 9-2.

10.2.3 Decontamination in Medical Emergencies

First-aid-trained personnel at the project task site will immediately evaluate (on a voluntary basis) a an injured or ill person. If serious, then the FTL will contact the appropriate facility personnel or Warning Communications Center (WCC) to summon emergency services (INEEL Fire Department and CFA Medical Facility) to the site.

Medical care for serious injury or illness will not be delayed for decontamination. In such cases, gross contamination may be conducted by removing the injured person's outer protective clothing (if possible) and other contaminated areas contained with a bag, glove, etc. If contaminated PPE cannot be removed without causing further injury (except for the respirator, which must be removed), the individual will be wrapped in plastic, blankets, or available material to help prevent contaminating the inside of the ambulance, medical equipment, and medical personnel.

The IH and/or RCT (depending on the type of contamination) shall accompany the employee to the medical facility to provide information and decontamination assistance to medical personnel. Then, contaminated PPE will be removed at the CFA Medical Facility and will be carefully handled to prevent the spread of contamination. Chapter 5 of *Manual 15B–Radiation Protection Procedures* and MCP-148, "Personnel Decontamination," contain information on proper handling of radionuclide-contaminated wounds.

10.3 Doffing Personal Protective Equipment and Decontamination

As stated earlier, no personnel decontamination beyond doffing of PPE is anticipated for this project. Careful removal of the outer PPE will serve as the primary decontamination method.

The specific doffing sequence of modified Level D or C PPE, and associated decontamination procedure, will be based on the nature of the contamination. A general approach for doffing modified Level D or C PPE is described below. However, there is no one doffing strategy that works for all circumstances. Modifications to this approach are appropriate if site conditions change or at the discretion of the project HSO in consultation with the project IH and RCT.

10.3.1 Modified Level D Personal Protective Equipment Doffing and Decontamination (If Required)

If required to be worn, modified Level D protective clothing (e.g., disposable coveralls) will be doffed following standard removal techniques (rolling outside surface inward and down) and will constitute the initial decontamination step. All PPE will be placed in the appropriately labeled containers.

10.3.2 Level C Personal Protective Equipment Doffing and Decontamination (If Required)

If respiratory protection is worn in conjunction with protective clothing (e.g., Level C PPE), then the modified Level D sequence will be followed with one additional step—to remove the respirator and place it in a separate container from the discarded protective clothing. Depending on the type of contamination encountered, this step will be followed by a radiological survey or IH evaluation.

10.4 Disposal of Contaminated Personal Protective Equipment and Other Equipment

10.4.1 Storage and Disposal of Investigative-Derived Waste Materials

Waste might include PPE and miscellaneous sampling materials (e.g., paper towels, plastic bags, and gloves). Based on previous sampling, it is not anticipated that any miscellaneous sampling materials will become contaminated. If contaminated, the waste will be bagged, secured with duct tape, and labeled in accordance with instructions from the RCT. If the waste is also potentially contaminated with nonradiological hazardous material, the FTL will need to determine whether the waste should be labeled and treated as mixed waste or nonradiological hazardous waste. The FTL may contact WGS for questions concerning waste characterization. The waste shall be stored in an approved CERCLA storage area pending laboratory analyses, if necessary. It is expected that the waste will be handled as conditional industrial waste to comply with the waste disposal and disposition form. Free release surveys of suspected radiologically contaminated waste will be conducted in compliance with MCP-425, "Radiological Release Surveys and the Control and Movement of Contaminated Materials."

Cold (nonradiological) waste is sent to the CFA Landfill or another INEEL-designated solid waste landfill. Low-level radioactive waste is stored in an approved area in accordance with MCP-3475, "Temporary Storage of CERCLA-Generated Waste at the INEEL." The waste will be evaluated for additional characterization and managed as low-level waste. Final disposition will be coordinated with WGS.

10.4.2 Site Sanitation and Waste Minimization

Waste materials will not be allowed to accumulate at groundwater-monitoring sites. Appropriately labeled containers for industrial waste and CERCLA waste (as required) will be maintained at the project site. Personnel should make every attempt to minimize waste through the judicious use of consumable materials. All site personnel are expected to make good housekeeping a priority at the job site.

11. EMERGENCY RESPONSE PLAN

This section defines the responsibilities for the project and the INEEL Emergency Response Organization (ERO) by providing guidance for responding to abnormal events during project activities.

This emergency response plan addresses OSHA "emergency response" activities as defined by 29 CFR 1910.120/1926.65, "Hazardous Waste Operations and Emergency Response"; and DOE "emergencies" as defined by DOE Order 151.1A, Change 2, "Comprehensive Emergency Management System"; and DOE Order 232.1A, "Occurrence Reporting and Processing of Operations Information." This response plan is implemented in concert with PLN-114, "INEEL Emergency Plan/RCRA Contingency Plan."

The "INEEL Emergency Plan/RCRA Contingency Plan" (PLN-114) may be activated in response to events occurring at the INEEL or at the discretion of the emergency coordinator (EC)/emergency action manager (EAM). Once the INEEL plan is activated, project personnel will follow the direction and guidance communicated by the EC.

Note: The OSHA term "emergency" is not defined the same as the DOE term "emergency." For simplicity, the term "emergency" is used in this section of the HASP to refer to events covered by either the OSHA or the DOE definition.

Emergency response plans must be developed and put into place before any project activity begins. Preplanning makes it possible for the project to anticipate and appropriately respond to abnormal events that can affect project activity. Preplanning also ensures that the project emergency response program is integrated with that of the INEEL.

On-scene response to, and mitigation of, site emergencies could require the expertise of both INEEL personnel and INEEL Fire Department personnel. Emergencies that could occur include:

- Accidents resulting in injury
- Fires
- Spills of hazardous or radiological materials
- Tornadoes, earthquakes, and other adverse natural phenomena
- Vehicle or transportation emergencies
- Safeguard and security emergencies
- Emergencies at nearby facilities that could prompt evacuation or take-cover actions at the task site.

11.1 Types of Emergency Events

11.1.1 Events Requiring Emergency Notifications

Certain events require courtesy notifications, but do not require a response from the INEEL ERO. In these cases, the project FTL or designee will immediately notify the facility shift supervisor (SS) or

SAD or the WCC. The FTL's notification should describe the event and state that no emergency response support is required. Examples of these types of events include, but are not limited to, the following:

- Personal injury at the site requiring medical evaluation or first-aid treatment, but not requiring an ambulance response
- Equipment or vehicle accident that results in damage to the vehicle or property ONLY
- Small fire that is immediately extinguished with a hand-held fire extinguisher (also requires notification to the INEEL Fire Department)
- Any other event deemed potentially reportable.

Note: In the majority of cases, monitoring sites are located outside the facility's fence. Therefore, the CFA SAD will be the primary contact for most emergency notifications. When inside the fence of a facility, emergency notifications should first be made to the plant SS. The SS will then notify the SAD or will instruct the FTL or designee to notify the SAD directly.

11.1.2 Events Requiring Local Project Evacuation or Idaho National Engineering and Environmental Laboratory Response

Some events that could occur at the project site might require support from the INEEL ERO or might require a local area evacuation of the project. In these cases, the project FTL will immediately notify the facility SS and/or SAD. If the facility SS and/or SAD cannot be contacted immediately, then the WCC will be contacted. The FTL's notification will describe the event and will request emergency response resources, as appropriate. After being informed of the event, the facility EC may elect to activate the command post. Once the command post is operational, all emergency response activities will be coordinated through the EC. The specific actions to be taken in response to emergency alarms are described in Section 11.3. Examples of these types of events include, but are not limited to, those listed below:

- Fire that is burning beyond an incipient stage and cannot be extinguished with hand-held extinguishers
- Large spill at the project that cannot be immediately contained or controlled
- Serious injury to a worker or workers.

Note: When the project site has been evacuated, the FTL will serve as the project area warden and will ensure that facility contact or EC (if command post is formed) notification is made that project personnel have been evacuated and accounted for.

11.1.3 Events Requiring Total Facility and Project Evacuation

In the event of a facility or INEEL site evacuation, the FTL will verbally notify all project personnel to evacuate by using the radio or the local evacuation signal. The notification may be via alarms or other communication (e.g., radio) as initiated by the EC for protective actions. For accountability purposes, the FTL will perform a positive sweep of the site before evacuation.

Note: When an evacuation is called for by the EC, the FTL will serve as the project area warden and will ensure that the appropriate facility personnel and EC (if command post is formed) notification has been made that project personnel have been evacuated and accounted for.

11.2 Emergency Facilities and Equipment

Emergency response equipment that will be available at the groundwater-monitoring site includes the items described in Table 11-1. The INEEL Fire Department maintains an emergency hazardous material response van that can be used to respond to an event or emergency at the project. The INEEL Fire Department personnel also are trained to provide immediate hazardous material spills and medical services. At least two people with current medic/first-aid training will be present at the project to render first aid on a voluntary basis. For serious injury, assistance from the INEEL Fire Department will be summoned. For fires that cannot be handled with the hand-held extinguishers, assistance from the INEEL Fire Department will be summoned. All fires of any size will be reported promptly to the INEEL Fire Department, even if site personnel have extinguished the fire.

Table 11-1. Emergency response equipment to be maintained at the site during operations.

Equipment Name	Location at Task Site	Responsible Person	Frequency of Inspection or Verification[a]
First-aid kit	Project vehicle or near DWA or CWA	HSO	Monthly—check seal only
Eyewash bottles[b] Eyewash station[b]	In or near DWA or CWA	HSO	Monthly
Hazardous materials spill kit	Project vehicle	HSO	Verification
Extra PPE	Project vehicle or support trailer	HSO	Verification
Communication equipment (operational)	Onsite	FTL	Daily radio check
Fire extinguishers[c]	In or near DWA or CWA	HSO	Monthly

a. Verification that equipment is present at the designated project location—no inspection tag is required.

b. An eyewash bottle will be used to provide an immediate eye flush, if required. The HSO will identify the location of the eyewash station during the prejob briefing.

c. A minimum of one 10A/60BC fire extinguisher. If used, return for servicing and recharging.

CWA = controlled work area
DWA = designated work area
FTL = field team leader
HSO = health and safety officer
PPE = personal protective equipment

11.3 Emergency Communications

In the event of an emergency, the capability to summon INEEL emergency response resources to immediately notify site personnel and inform others of site emergencies is required. Communications equipment at the task site will be a combination of radios, telephones (e.g., mobile, cellular, or facility), and pagers. The following, as necessary, will be used during emergencies:

- To get help from the INEEL Fire Department, site personnel will use radio communications, call 777, or call 526-1515. The INEEL facility telephones are linked to 777. Use *777 on INEEL mobile or cellular telephones or go through the INEEL WCC at 526-1515.

- Verbal communication, radios, or cell phones will be used to notify site personnel to stop work and take cover or evacuate the site, as applicable.

- For sites that are located in the field (i.e., inside the INEEL boundary, but outside of any specific facility boundaries), the POC will be the FTL or HSO. The POC maintains communications with fieldworkers at all times and can notify fieldworkers of facility or Sitewide emergencies that could affect the task site.

- Where applicable, the appropriate facility SS or SAD will be notified.

- Site personnel will provide the following information (as available) when communicating emergency information to the INEEL site emergency telephone number, the WCC, or the point of contact:

  - The caller's name, title (e.g., FTL or HSO), telephone number, and pager number.

  - Exact location of the emergency.

  - Nature of the emergency, including time of occurrence, current site conditions, and special hazards in the area.

  - Injuries (if any) including numbers of injured, types of injuries, and conditions of injured.

  - Emergency response resources required (e.g., fire, hazardous material, and ambulance).

  - Additional information, as requested.

11.4 Emergency Recognition and Prevention

All project personnel should be constantly alert for potential hazardous situations and signs as well as symptoms of chemical exposure or releases. All project personnel will be trained in proper site access and egress procedures, in response to project events and INEEL emergencies, as part of the project-specific training. Visitors also will receive this training on a graded approach, based on their access requirements. Alarm identification, location and use of communication equipment, location and use of site emergency equipment, and evacuation routes will be covered. Emergency phone numbers and evacuation route maps will be located onsite.

11.5 Emergency Response Roles and Responsibilities

11.5.1 The Idaho National Engineering and Environmental Laboratory Emergency Response Organization

The INEEL ERO structure is based on the Incident Command System (ICS). The ICS is an emergency management system designed for use from the time an incident occurs and is responded to until it is terminated. The system consists of procedures for controlling personnel, facilities, equipment, and communications. It allows for activating emergency response resources in a graded approach depending on the nature and seriousness of the event. The ICS is implemented as a chain of command

operating on three basic levels. They consist of (1) the on-scene-commander (OSC), (2) Command Post/Emergency Control Center, and (3) INEEL Emergency Operations Center.

The OSC has the tactical and command responsibility for the control of an emergency at the scene, a fire, hazardous material response, and as a special rescue response. The senior INEEL Fire Department officer responding for the INEEL Fire Department fills this position. If the event is primarily a security incident, the senior responding protective forces officer will assume the duties of the OSC. In some instances, the incident response team leader (IRTL) may function as the OSC until relieved by a higher-tiered authority. The IRTL reports to the OSC who reports to the EC/EAM. The Incident Response Team acts at the first responder awareness level by providing initial control, personal protective measures, and incident assessment and mitigation as directed by the IRTL.

The project FTL and HSO, as well as a designated replacement, will be trained at the first responder awareness level and will take immediate actions to:

- Understand the potential outcomes associated with an emergency when hazardous substances are present
- Understand what hazardous substances are and the risks associated with them in an incident
- Recognize the presence of hazardous substances in an emergency
- Identify the hazardous substances, if possible
- Perform the roles of a first responder at the awareness level
- Realize and understand the need for additional resources.

The Command Post/Emergency Control Center is the second tier of the emergency response line organization and is headed by the EC/EAM. The EC/EAM is responsible for all emergency response actions within the entire facility, including advising the OSC. The Command Post/Emergency Control Center is activated for actual or potential emergencies or at the direction of the EC/EAM. If the Command Post/Emergency Control Center is activated in response to an event at the project, then the project will send a representative to the Command Post/Emergency Control Center to advise the EC/EAM.

The Emergency Operations Center is the upper tier of the ERO and is headed by the INEEL emergency director. The emergency director is responsible for all emergency response actions at the INEEL, including advising the EC/EAM. Project personnel do not normally provide direct support to the Emergency Operations Center.

11.5.2 Project Personnel Involved in Emergencies

11.5.2.1 Field Team Leader. The FTL (or designated alternate) is responsible for initiating all requests for emergency services (e.g., fire and medical) and for notifying the appropriate facility personnel (SS and/or SAD) of abnormal events that could occur during the project. The FTL also will serve as the area warden (or designate that responsibility to another area warden trained person) and conduct personnel accountability. In addition, the FTL will control the scene until a higher-tiered ICS authority arrives at the scene to take control. When relinquishing this role, the FTL (or designated alternate) will provide all requested information regarding the nature of the event, potential hazards, and other requested information.

11.5.2.2 Project Personnel. Every person at the groundwater-monitoring site has a role to play during a project event or INEEL emergency. Each employee must be constantly aware of potential problems or unexpected hazardous situations by immediately reporting these situations to the FTL. All personnel are expected to watch out for their fellow workers, to report their concerns to the FTL, and to respond to emergency events as described in this HASP. Roles and responsibilities are further detailed in Table 11-2.

Table 11-2. Responsibilities during an emergency.

Responsible Person	Action Assigned
FTL (or designee)	Contact the INEEL site emergency telephone number or WCC.
FTL (or designee)	Conduct accountability and report to appropriate facility personnel.
FTL (or trained designee)	Serve as the area warden.
HSO and medic or first-aid-trained personnel	Administer first aid to victims (voluntary basis).
Trained project personnel	Extinguish fires (incipient fires only).
FTL	Contact the facility SS or SAD.
FTL (or designee)	Report spills to the INEEL Spill Notification Team.
FTL	Report all fires (including those extinguished by project personnel) to the INEEL Fire Department.
FTL or HSO	Report occupational injuries/illnesses to the Occupational Medical Program.
FTL (or designee)	Support the facility command post technical representative, as requested.

FTL = field team leader
HSO = health and safety officer
INEEL = Idaho National Engineering and Environmental Laboratory
SAD = site area director
SS = shift supervisor
WCC = Warning Communications Center

11.6 Emergencies, Recognition of Warnings, and Response

11.6.1 Spills

Equipment refueling tasks, broken equipment hydraulic lines, and containerization of purge water are examples of scenarios that have a likely potential to result in spills. If the spills are small enough to be safely contained at the task site, task site personnel will handle spill control using spill supplies at the site and will immediately report the incident to the appropriate facility personnel. For large spills, assistance from the INEEL Fire Department will be summoned. All spills will be reported promptly to the INEEL Spill Notification Team at Pager #6400. If any release of a hazardous material occurs, task site personnel will comply with the following immediate spill-response actions:

Untrained Initial Responder (or if the material characteristics are unknown):

- Place equipment in a safe configuration
- **Evacuate** and **isolate** the immediate area
- Notify and then **seek help** from and **warn** others in the area
- **Notify** the FTL.

Trained responder, material characteristics are known, no additional PPE is required:

- Place all equipment in a secure configuration
- **Seek help** from and **warn** others in the area
- **Stop** the spill, if it can be done without risk (e.g., return the container to upright position, close valve, and shut off power)
- **Provide** pertinent information to the FTL
- **Secure** any release paths only in an emergency.

11.6.2 Alarms

Alarms and signals are used at the project site and INEEL to notify personnel of abnormal conditions that require a specific response. Responses to these alarms are addressed in general employee training. In addition to the alarms previously described, emergency sirens located throughout the INEEL serve as the primary means for signaling emergency TAKE COVER or EVACUATION protective actions. When monitoring sites are located outside facility boundaries, the FTL must ensure the proper individuals are notified in accordance with MCP-2725, "Field Work at the INEEL," to ensure the field team will be notified of any area emergencies. To signal site personnel of a project-initiated emergency event, a separate set of emergency signals has been established based on horn blasts (e.g., vehicle). These signals are described in Table 11-3.

Table 11-3. Project internal emergency signals.

Device or Communication Method	Signal and Associated Response
Vehicle Horn Blasts	**One long blast**—Emergency evacuation, evacuate project site immediately. Proceed in an upwind direction to designated assembly area, as specified by the FTL. **Two short blasts**—Non-emergency evacuation of immediate work area. Proceed to designated assembly area, as specified by the FTL. **Three long blasts** or verbally communicated—All clear, return to project site.

FTL = field team leader

11.6.2.1 Take Cover—Continuous Siren. Radiation or hazardous material releases, weather conditions, or other event or emergency conditions could require that all personnel take cover indoors in the nearest building. A TAKE COVER protective action may be initiated as part of a broader response to an emergency and may precede an evacuation order. The order to TAKE COVER usually is announced by activating the emergency siren. The signal to take cover is a CONTINUOUS SIREN that can be heard throughout the area. Remember, **STEADY = STAY**. However, the order to take cover also can be given by word of mouth, radio, or voice paging system. When ordered to TAKE COVER, project personnel will place the site in a safe condition (as appropriate) and then seek shelter in the nearest building. Vehicles may be used for shelter if there are no buildings nearby. Eating, drinking, and smoking are not permitted during take-cover conditions.

11.6.2.2 Total Area Evacuation—Alternating Siren. A total area evacuation is the complete withdrawal of personnel from the Site. The evacuation signal is an ALTERNATING SIREN. Remember, **ALTERNATE = EVACUATE**. A single long blast of the vehicle horn serves as the project's alternate emergency evacuation alarm. However, the order to evacuate also can be given by word of mouth, radio, or voice paging system. When ordered to EVACUATE, project personnel will place the site in a safe condition (as appropriate) and then proceed to the assembly area as directed by the EC. Eating, drinking, and smoking are not permitted during emergency evacuations.

11.6.2.3 Local Area Evacuation—Vehicle Horn Blast. A local area evacuation is the complete withdrawal of personnel from the project site, but it does not require the complete evacuation of the entire area. A single long horn blast (vehicle) will serve as the project's primary emergency evacuation signal (as listed on Table 11-3). However, the order to evacuate also can be given by word of mouth, radio, or voice paging system. When ordered to evacuate the project site, personnel will place the site in a safe condition (as appropriate) and then proceed along the specified evacuation route to the assembly area designated for local area evacuations or as directed by the FTL. Eating, drinking, and smoking are not permitted during emergency evacuations.

11.6.3 Personnel Accountability and Area Warden

Project personnel are required to evacuate the site in response to TAKE COVER, EVACUATION, and local evacuation alarms. In each case, the FTL (or trained designee) will account for the people present on the site at the time the alarm was initiated. The FTL (or trained alternate) serves as the area warden for the project and completes the personnel accountability (following positive sweeps of the project site) based on the attendance log. The results of this accountability will then be communicated to the FTL for reporting to the appropriate facility personnel.

11.6.4 Notifications

The SAD is responsible for immediately notifying the DOE and local off-Site agencies of all significant abnormal events that occur during the project. This duty is in addition to the notification requirements established in INEEL procedures for events that are categorized as emergencies or unusual occurrences. For this reason, the project will immediately report all abnormal events that occur on the site to the appropriate facility SS (where available) and to the WCC. The WCC will, in turn, notify the appropriate INEEL emergency response resources and other INEEL facilities, as appropriate. The facility SS and the WCC share the responsibility for notifying the EC/EAM and SAD. Normally, the FTL is responsible for making the event notifications described above. The FTL may make additional notifications at the discretion of project supervision.

Note: Some monitoring well locations lie just outside a facility fence and may be considered to be under that facility's jurisdiction. In these cases, both the facility SAD and the CFA SAD may have simultaneous responsibility for the project. When this occurs, a decision will need to be made as to which SAD will be the primary contact (directly responsible in emergency situations) and which will be the secondary (receives emergency notifications as courtesy information only) contact. The primary and secondary jurisdiction determination shall be addressed in the prejob briefing and be made known on the respective facilities' PODs.

The EC/EAM is the single POC between the project and the INEEL ERO and off-Site people or agencies. The EC will make all off-Site notifications and all media requests concerned.

11.6.5 Evacuation Routes and Medical Facilities

Evacuation routes and assembly areas will be determined before beginning work at each monitoring location. The evacuation routes shall be discussed with project personnel at each prejob briefing in accordance with MCP-3003, "Performing Pre-Job Briefings and Documenting Feedback." The "INEEL Emergency Plan/RCRA Contingency Plan" (PLN-114) contains maps of facility evacuation routes, which the FTL may use as a reference. If a total area evacuation is ordered, then project personnel will relocate to the determined evacuation assembly area or respond as directed by the EC/EAM. The locations of the CFA medical facility and fire station, Test Area North dispensary and fire station, Idaho Nuclear Technology and Engineering Center infirmary, and Test Reactor Area infirmary are shown in Figures 11-1 through 11-4.

11.7 Reentry and Recovery

11.7.1 Reentry

During an emergency response, it is sometimes necessary to reenter the scene of the event. Reasons for performing a reentry include:

- Performing personnel search and rescues
- Performing medical first-aid responses
- Performing safe shutdown actions
- Mitigating actions
- Evaluating and preparing damage reports
- Performing radiation or hazardous material surveys.

Reentries will be carefully planned to ensure that personnel are protected from harm and to prevent initiating another emergency event. Reentry planning is undertaken as a graded approach depending on the nature of the initiating event.

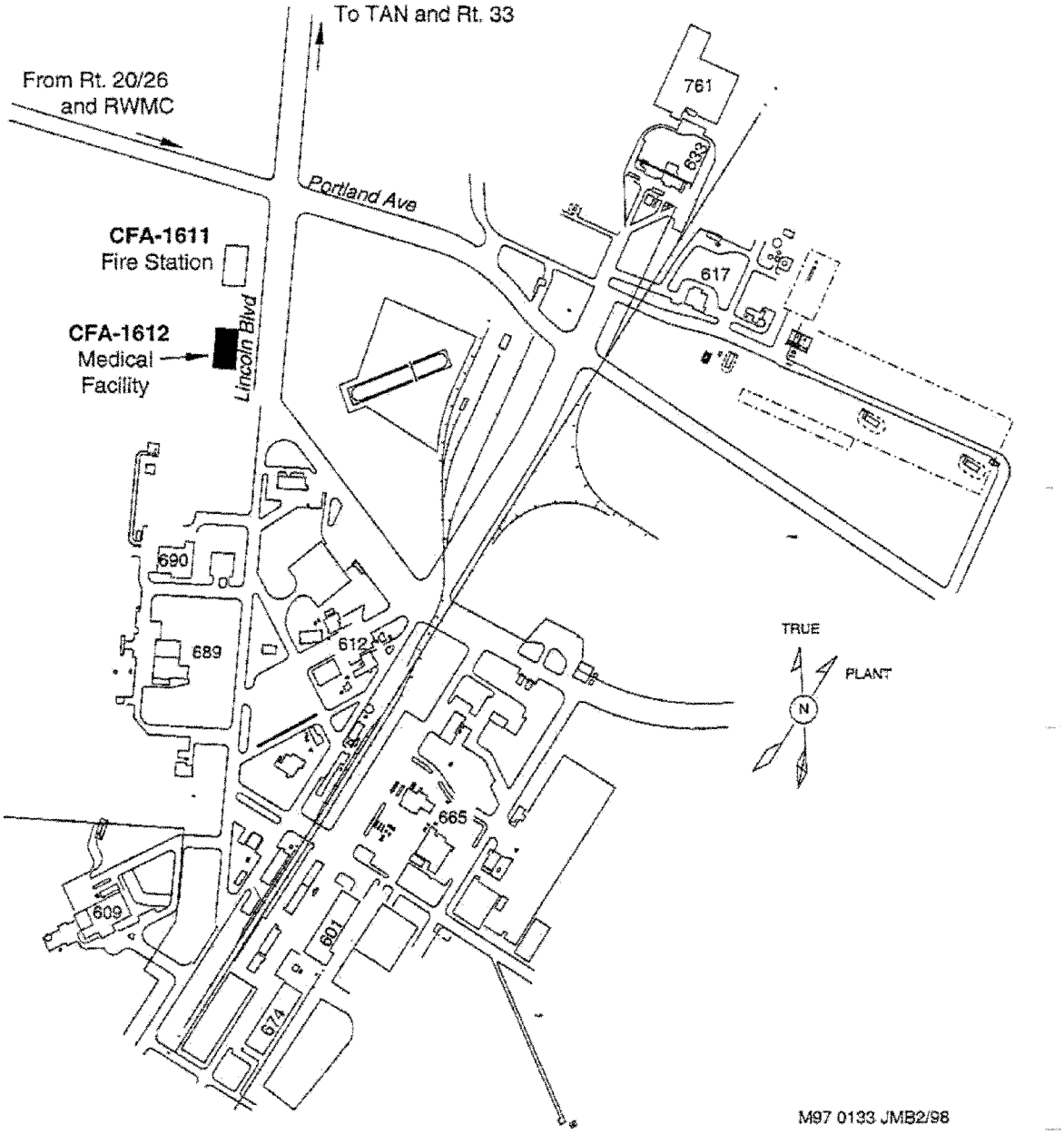

Figure 11-1. Map showing the location of the Central Facilities Area Medical Facility (CFA-1612).

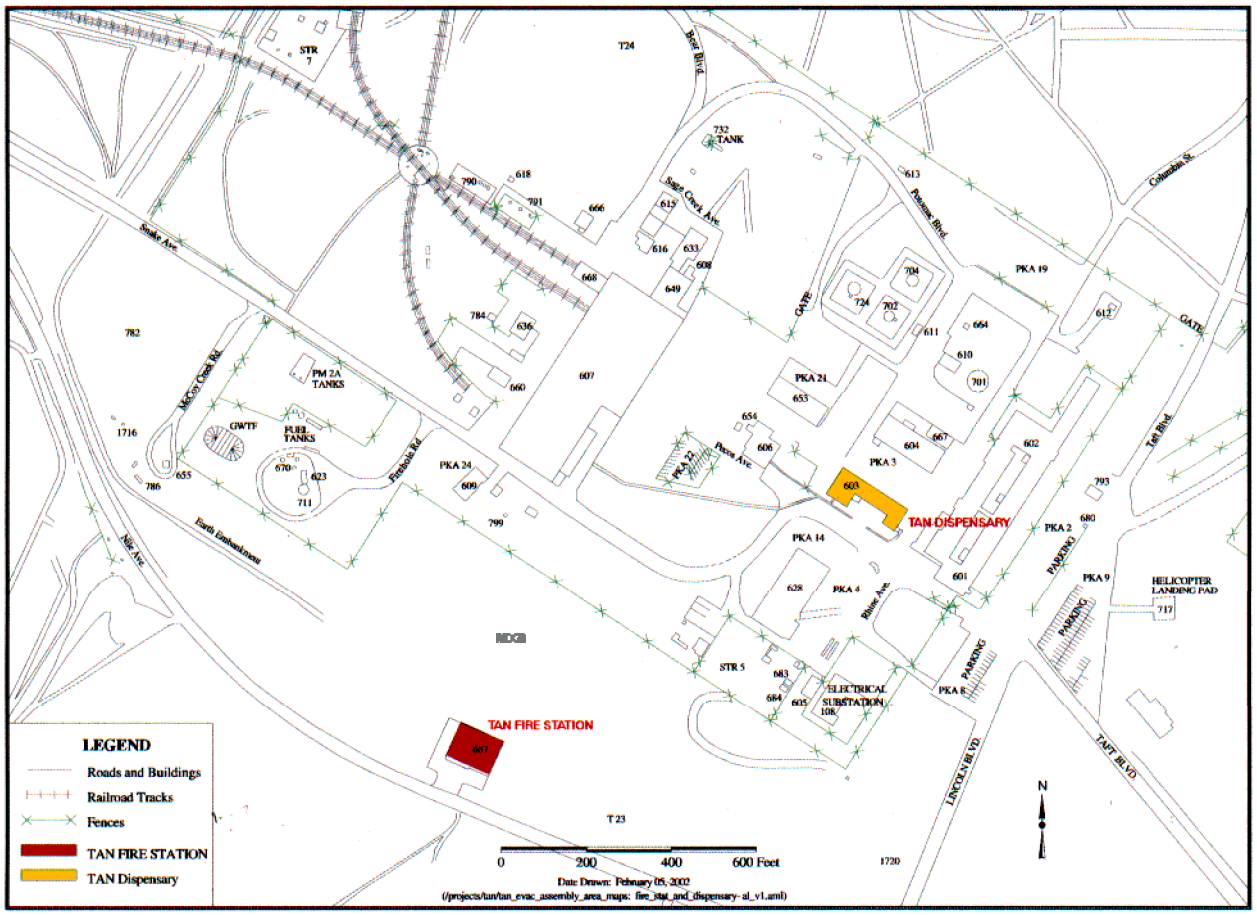

Figure 11-2. Map showing the location of the Test Area North dispensary and fire station.

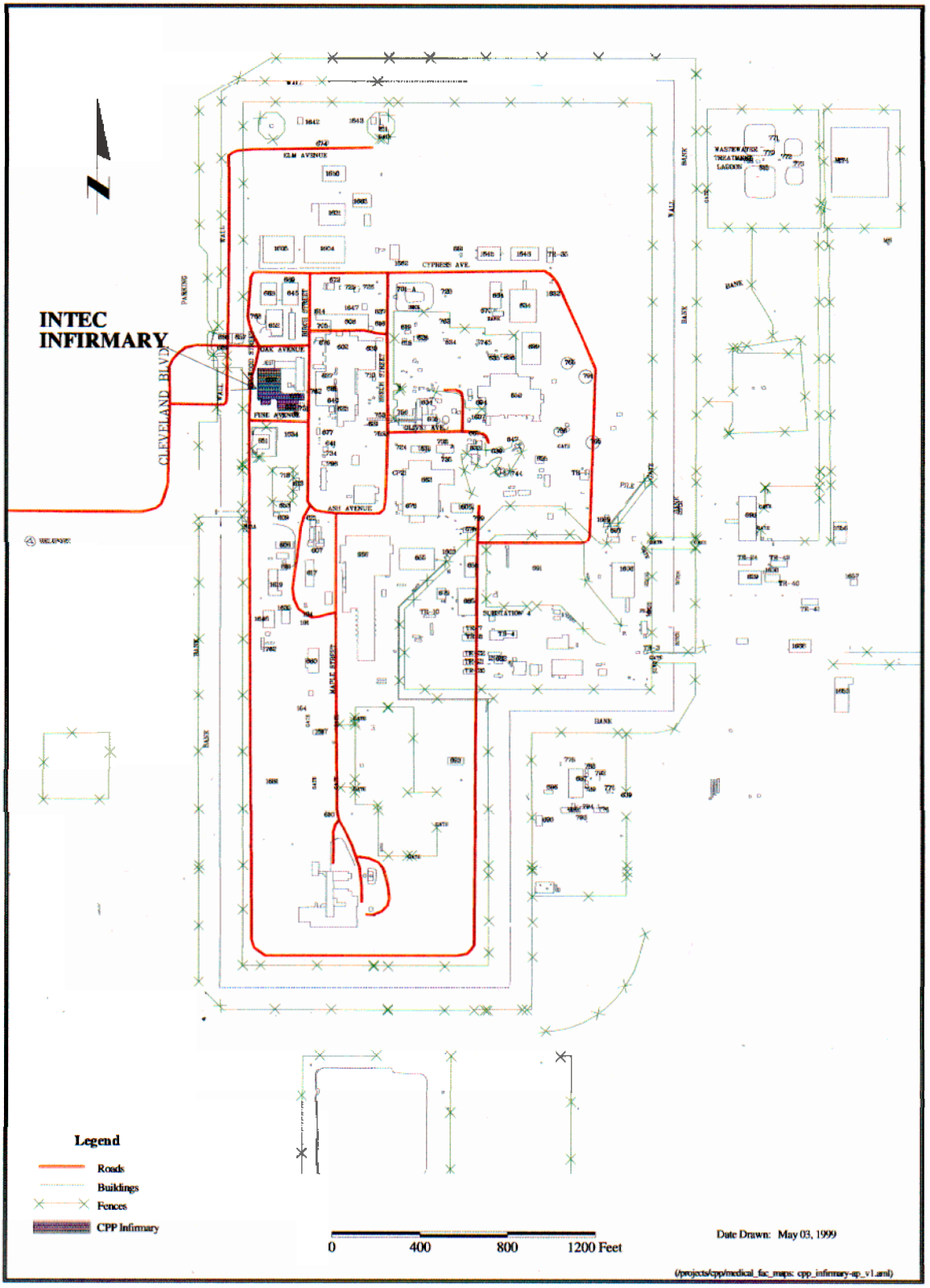

Figure 11-3. Map showing the location of the Idaho Nuclear Technology and Engineering Center infirmary.

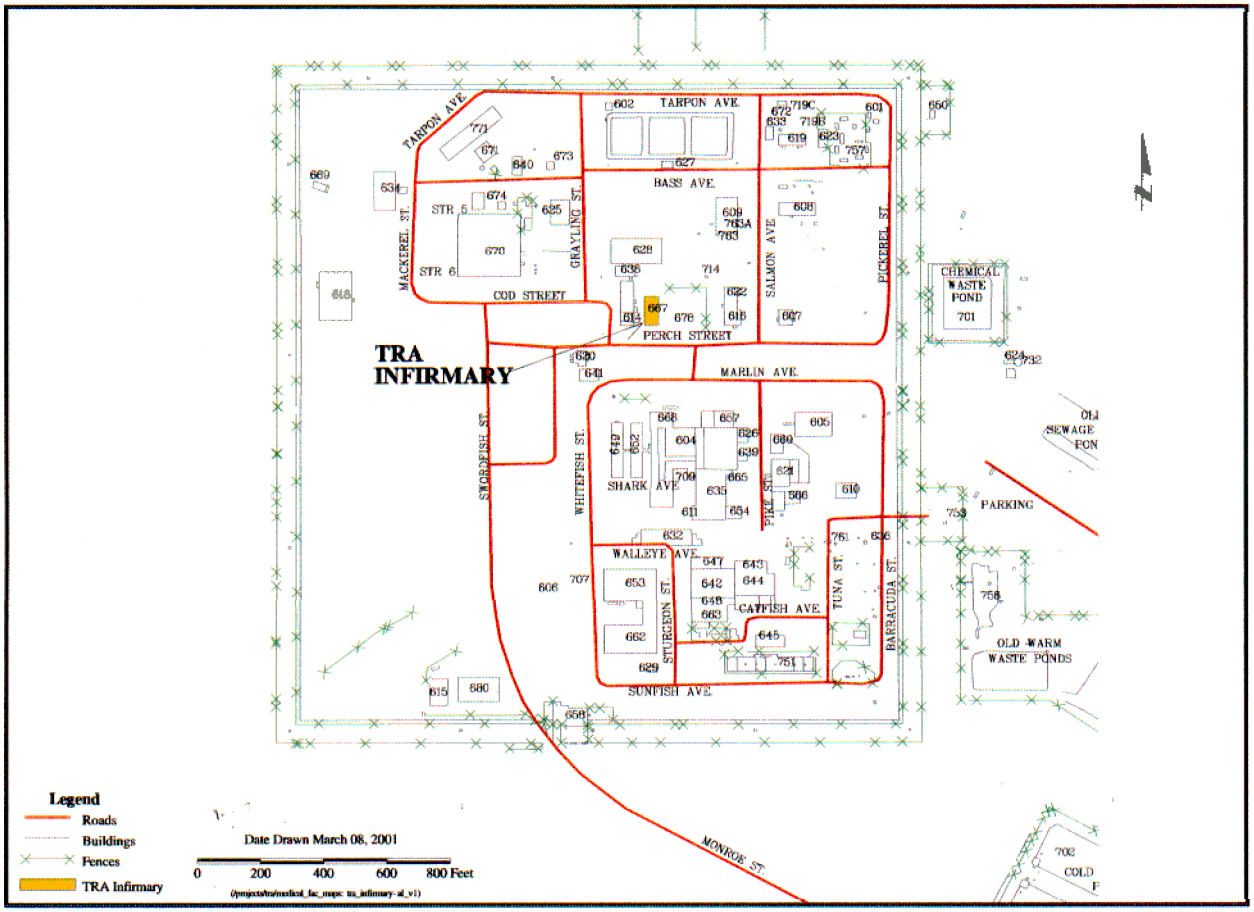

Figure 11-4. Map showing the location of the Test Reactor Area infirmary.

11.7.2 Recovery

After the initial corrective actions have been taken and effective control has been established, response efforts will shift toward recovery. Recovery is the process of assessing post-event and post-emergency conditions and developing a plan for returning to pre-event and pre-emergency conditions (when possible) and following the plan to completion. The EC/EAM is responsible for determining when an emergency is sufficiently stable to terminate the emergency and enter the recovery phase. The PM (with concurrence from the SS, SAD, or facility manager) will appoint the recovery manager.

11.8 Critique of Response and Follow-up

A review and critique will be conducted following all emergency events, drills, and exercises at the INEEL. In some cases, an investigation may be required before commencing recovery actions. For this reason, care should be exercised to preserve evidence, when appropriate.

11.9 Telephone and Radio Contact Reference List

It is not feasible to include a master telephone and radio contact reference list in this HASP due to the Sitewide characteristics of this project. Such a list may be created and updated as needed and made available at the project site. Table 11-4 lists the standard INEEL emergency contact numbers that are applicable to a Sitewide project. This list will be made available at the project site.

Table 11-4. Emergency contact numbers.

Contact Title	Phone Number/Radio Net
INEEL Emergency Response Telephone Number	777
Warning Communications Center	526-1515, KID-240
First Aid (CFA Medical Dispensary, CFA-1612)	777, 6-2356
Occupational Medical Program	6-1596
Fire/Security	777
Facility Shift Supervisor	TBD*
Facility Site Area Director	TBD*
INEEL Spill Notification Team	Pager 6400

* TBD = To be determined by FTL before commencing work at each location.
CFA = Central Facilities Area
FTL = field team leader
INEEL = Idaho National Engineering and Environmental Laboratory

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